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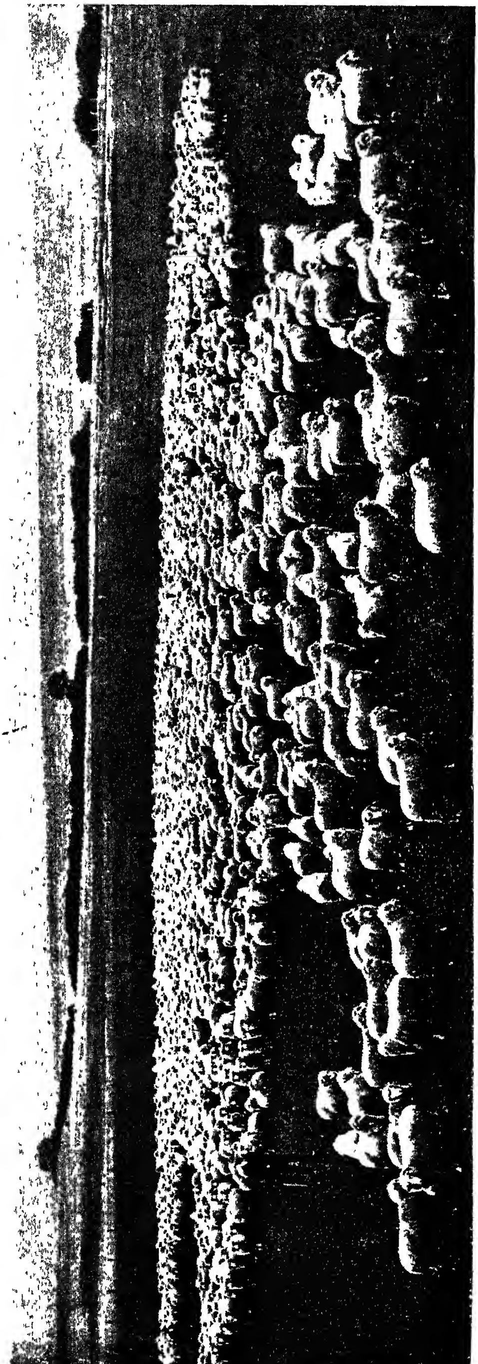

The utility of the big framed type of Merino is becoming more recognised in the dry areas than, perhaps, in the more favoured parts. Proof of its suitability to dry conditions may be judged from the flock shown in this illustration.

These ewes were reared on country capable of carrying approximately only 40 sheep to the square mile. After rearing 88 per cent. of lambs, they cut an average weight of 11 lb. 7 oz. of a serviceable class of wool.

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Agricultural Gazette of New South Wales.

Sheep and Wool for the Farmers.

A NEW OUTLOOK.

J. WRENFORD MATHEWS.

The question of Stocking and Feeding.

COMPARATIVELY few, even of those actually engaged in the wool trade, recognise what an immense and well established industry it really is, or how largely the prosperity of Australia is bound up in its vigorousness and extent. Yet this vast industry is about to undergo still further extension. Such growth will and must be along new lines. In the past we have only been too glad to get the land occupied, and yielding some return, however small. Under these circumstances we have been content to carry, even with a good rainfall, little more than one sheep to the acre. Indeed, large areas in New South Wales are still carrying sheep on this numerical basis. In some parts of the State, for example, those unsuitable for agriculture or with a deficient rainfall, this or a less proportion must continue.

The outside Country.

It is to the "outside country" that we must look to keep the merino intact in large flocks and sparsely depastured over wide areas. But even in country that must always be reserved to the merino, the old order changes. We have passed from the era of shepherded flocks to one in which every run is fenced and securely wire-netted.

The stock has been given a double chance by vigorous war on the rabbit and by water conservation, and this latter too on such systems as to keep the sheep distributed over the run instead of being confined to the pastures around a single source of supply. Thus the business of the squatter in the saltbush country is less of a long gamble with the seasons than it used to be. Whether this improvement is due to drought experiences or to the higher prices obtainable for wool during later years it would be hard to say. All we know is, not only is the merino country showing higher returns for capital invested, but a great improvement is noticeable both in the type of sheep kept within these areas, and in the class of wool marketed. This splendid work has not been accomplished in a few years, nor without great cost and long experiment. The very greatest credit is due to those men who have risen to the occasion, and bred the types of sheep best fitted to resist the trying conditions to be met with in such localities.

Agricultural Areas.

We are specially concerned, however, with the less arid areas of the State, the country with a higher rainfall and more or less suitable for agriculture. The steady rise in land values which has accompanied the increase in population has led to the enunciation of a new policy. The days of enormous runs, at all events on land suitable for agriculture, are numbered. They have met a need and met it well, but that need is lessening daily. The big run having served its turn is fated to undergo subdivision and closer settlement.

In the past, New South Wales has filled a most important place as the premier wool-producing country of the world. But during later years the production of wheat and other cereals has been steadily increasing. In a wider sense both industries may be said to be still in the experimental stage. The land is the great source of wealth, and we cannot continue to let the great part of such wealth lie idle. We cannot have two-thirds or more of our capital unproductive. More mouths are to be filled, and there is only the same land area to provide the necessary sustenance. Hence the necessity for more profitable methods.

How is this need to be met? Older countries have all faced this problem at some period or other of their history. England has arrived at a solution; and it need not take much study to see that that solution holds good for most other cases. Hitherto the grazier and the agriculturist have been almost, if not entirely, distinct. Either calling may have been chosen, but it has occurred to comparatively few men to combine the two. Yet what is generally known as "mixed farming" has given the greater profits required by her increased land values, and solved the problem for England. America with her big population has, like England, after exhaustive experiments, arrived at the same conclusion. New Zealand, where land has reached almost its maximum value, has progressed on these lines. In South Australia, though land suitable for similar methods is limited, these methods have been applied as far as possible. Australia, and more particularly New South Wales, may confidently accept "mixed farming" as the solution of the land problem.

Mixed Farming.

The position is getting increasingly difficult for the squatter and vastly easier for the farmer on a smaller scale, always provided that the latter be energetic, and, above all things, up-to-date. Formerly a man in search of a nice easy living turned his attention to sheep, but in these days of more intense cultivation and more scientific stock-breeding, slipshod methods mean certain failure.

Taking for granted then, that for the army of men which our closer settlement policy is placing on the land, mixed farming is almost imperative, the question arises—What combination will be the most suitable? If he is to unite agriculture with stock-raising, what kind or kinds of stock will he decide to employ? The choice is not very wide. It must be either cattle, sheep, pigs, or just, possibly, horses.

The latter does not call for special discussion. The dairy cow is the most profitable of all classes of live stock, and on very rich lands no animal can displace her. With her we find more closely associated the pig; in fact to dairy-farming on anything like a large scale, pig raising is an almost inseparable adjunct.

Sheep and Cattle.

Sheep and cattle do not generally form nearly so suitable a combination, though on some lands of the rougher districts, the two have been worked together with great advantage. While cattle crop the longer and ranker herbages, sheep by the aid of their close bite nibble the short sprouts of the plants that grow beneath, which causes their roots to spread, thus producing a sweeter and more luxuriant pasture. Sour country in many parts of Australia has been sweetened in this way.

The first stages of such improvement will, however, only be obtained at the expense of the sheep. The development can only be gradual and the sheep will have to undergo hardship, and continue to suffer until the pastures have mellowed sufficiently to provide them with sweeter grasses and herbage of a more nutritive nature. With such development a gradual improvement will be noticed in the sheep. In choosing sheep to perform such important duties of pioneering, hardiness of breed is most essential and must be considered before excellence of type. This is shown by the increased numbers of sheep now kept within coastal districts. Such cases are, however, exceptional. In general, conditions suitable to one do not conduce to the success of the other. Sheep are kept to better advantage in inland and drier climates. Whilst this proves the rule, we must not, however, lose sight of the fact that there are many breeds, and amongst the numbers there are to be found some suitable to almost any climate. This matter will, however, be considered in detail at a later stage. Our present object is to discuss the sheep as a factor in up-to-date mixed farming.

Old methods and new.

It seems almost unnecessary to point out the many advantages of having a small flock of sheep on the farm, yet comparatively few farmers have given this important branch of stock-raising the attention it deserves. We can hardly contrast the position of the farmer of to-day with that of the man who pioneered the industry, and indeed it would be quite an unfair comparison. The two have worked under entirely different circumstances. In the past it was no uncommon thing to find a farmer putting in his crop and going off to seek temporary employment, such as shearing, while it ripened. The presence of a flock of sheep on the farm would make this impossible, but the farmer would speedily discover that it paid better to place the business on a somewhat higher plane, and that he would increase his income more by giving proper attention to his farm and flock than by resource to any such casual methods.

Suitability of Sheep.

No class of live stock can be handled so cheaply as sheep; no class furnishes such quick returns, or so many sources of profit direct and indirect. It provides the farmer's household with a very necessary article of diet at cost price; it keeps the fallows healthy and free from weeds; its very presence enriches the soil and maintains it in its highest state of fertility. When bred, as it should be, on the farm itself, the sheep is content, highly domesticated, and adapts itself readily to circumstances. But Australia does not require any great adaptation in this respect. No country in the world can compare with it in its suitability to sheep. Indeed, one is tempted to wonder why the sheep was not indigenous to our continent. It is interesting to note the greater difficulty experienced in getting the various breeds to thrive in, say, Argentine or the United States, as compared with the ease with which they have become acclimatised in Australia. They have withstood the most trying conditions, and even the great droughts have but served to demonstrate the magnificent constitution of the merino. To-day, in spite of a heavy impost, buyers from the United States are taking increasingly large quantities of our high-grade merino and crossbred wools. We have the world's wool market at our door. Over and above all this, lambs, when bred from the right types, are saleable at good prices at a comparatively arly age.

Sheep and Wheat.

With the reservation that no single plan can hold good for the varied soils and climates of a large State like New South Wales, we may yet confidently assert, that is in the cereal-growing areas, and more especially in the wheat districts, that sheep will prove of the greatest utility. Our present aim is to discuss this newer phase and to indicate in broad general terms how the man engaged in mixed farming can manage his smaller flock to greatest advantage. His two great problems are—(1) To what extent shall he stock, and (2) What are the best methods to adopt in the keeping of his flock? The questions of carrying capacity and feeding are of the utmost importance to the practical farmer. His object is twofold. Not only must he obtain the maximum direct return from his flock, but he must consider also how best to utilise the presence of that flock to secure increased yields from his cereal crop.

Overstocking.

Perhaps the first article of the grazier's creed written on the fly-leaf of his note-book, governing all his buying and selling of stock, and the whole internal economy of his run, is—"Don't overstock." Any experienced man knows that the matter is one of vital importance. Unless the beginner acquire this wisdom by imitation, he will certainly learn it by experience. He must remember that six sheep well kept will give him a better return than eight which have been indifferently fed. Stock must never lose condition. Nothing is more trying or costly to the man on the land than the possession of large numbers of stock which he cannot properly feed. In the

The great improvement effected in the type of Merino now being kept in the outside country is shown by the group of wethers illustrated. These sheep were grown on saltbush country, and cut an average weight of 16 lb. of wool for the twelve months' growth, and yielded a most profitable carcase.

Feeding off Early Wheat Crop.

outside country overstocking has done more harm than drought or the rabbit invasion. It has almost ruined thousands of miles of some of the best sheep pastures in Australia Witness the huge stretches of naked, wind-swept plain within the saltbush areas, which have been reduced to that condition by the improvident method of allowing the edible bushes to be wholly eaten out.

Understocking.

Whilst I hold strongly to the opinion that overstocking is next door to a curse, yet within areas suitable to agriculture, and where some system of feeding is in vogue, the fear of overstocking must not be allowed to carry us too far in the opposite direction. This also means decreased profits. The problem, therefore, is how to get the maximum profit out of the land when its carrying capacity is varying considerably even from month to month. The case demands some definite system, and a sound system, too. If we are going to maintain the present high and increasing values, we must keep the land in a higher state of fertility, and adopt means by which we can get more out of the soil. We cannot hope for profits at present values by methods applicable when land was selling at half its present price. In what way, then, may the land be put to more profitable account? Clearly we cannot afford to keep any less stock than we have formerly. The additional revenue must, therefore, necessarily be obtained from the growing of cereal crops. Of these it is scarcely necessary to specify wheat as being the most suitable and profitable in conjunction with sheep-raising.

Rotation of Crops.

Any experienced farmer knows that he cannot go on growing the same crop year after year without steadily diminishing yields. Every crop takes from the soil certain substances necessary to plant life. The absence or diminution of such substances affects subsequent crops of the same kind. The land, therefore, must be allowed a period of rest in which to replace the loss by natural processes and regain its normal condition, or the elements taken away may be restored in the form of suitable fertilisers. In the past too little attention has been paid to this important question, yet even this does not meet the case unless the fertilisers are judiciously used. In any case, good cultivation is essential; indeed, so important a factor is it, that some still hold to the opinion that a better crop can be grown by well working the soil than by the use of fertilisers. Even to this we may concede. But alth ugh good cultivation may do wonders for the cereal crop, yet it is afterwards in the increased food supplies of the pastures which follow its use that the full benefit of manure is obtained; a decided advantage, which makes for largely-increased profits. Still better is the system of alternate cropping. This depends on the fact that, although all crops take substances from the soil, yet all crops do not take the same substances. It is nearly two hundred years since an English statesman encouraged by his example the method of rotation of crops. Formerly the practice in England had been to grow wheat for two years in succession, and let the land lie fallow every third year. This nobleman showed, however, that turnips might be grown to advantage every third year, and the

land still recover quite well for the succeeding wheat crop. It is well known to the later generation of farmers that land weakened, as it is to some extent, by a crop of wheat, may yet be quite fit to grow rape or barley, and further, will during the growth of the latter crop regain its full capacity for the succeeding wheat crop.

The General Method.

Modern methods embrace both alternation of crops and the use of fertilisers. Phosphatic manures are steadily coming into favour, and a brief reference to the ways in which they are employed may not be out of place. In some cases everything has been sacrificed in their use to the cereal crop with which the heavier dressings have been used. Whether such dressings should be applied at the planting of the fodder or cereal crop, or both, is a matter still to be finally determined by careful experiment. At present the weight of evidence seems to favour manuring the cereal crop; not so much with a view to obtain a higher wheat yield as to increase the subsequent carrying capacity of the pasture lands, for in mixed farming such as we advocate, the herbage grown on the pasture as a feed for sheep is a most important factor. Still, it is impossible to lay down any hard and fast rule, as their usefulness varies under different conditions. The principal food supply for the sheep must be the fodder crops grown alternately with wheat. Stubble and pasture must fill the interval between the harvesting of the cereal crop and the time when the fodder crops become available.

Natural Pasture.

Every holding on which sheep are kept should include an area of natural pasture to be reserved as a standby, either to tide over any unexpected failure of the fodder crops or stubbles, or to provide a change from these supplies. Nothing so helps to improve the condition of sheep as constant variety in feeding. A natural pasture possesses the additional merit of being available at any time of the year.

The greatest difficulty experienced by the South Australian farmer of the drier areas is to find sufficient feed for his sheep on the stubble and pasture during these earlier months, as the autumn rains do not generally fall until April, or even May. In many districts of New South Wales, however, this difficulty does not so often present itself. Ordinarily, late summer or early autumn rains fall during February and March, with the result that the crops which catch these rains are available in April and May. This ensures a good supply of early winter and spring feed for the stock.

But natural pastures, fallow, and stubble combined are insufficient to carry the full number of sheep throughout the year, nor is it intended that they should. With mixed farming methods, breeding ewes should constitute the great majority of the flock, so that it is in the autumn (say May), when the lambs should be dropped, that the carrying capacity of the farm must reach its maximum. The direct profit from the sheep depends on the condition in which the lambs arrive at market, and the state of the ewes at shearing, both of which depend almost wholly on feeding. Neither must suffer any check.

Sheep on Rape at Cowra Experiment Farm.

Second Growth of Rape at Cowra Experiment Farm, August, 1909—4 months after being completely eaten down by sheep.

Fodder Crops.

This brings us to the most important factor in our system of alternate cropping—the question of fodder crops—what varieties most relished by sheep, and suitable for feeding off, will become available at the time when most required? We must choose crops of early autumn growth. Sometimes legumes are employed. These plants are destined to fill a most important place in future systems of cropping; but as they mature later, this later maturity must be taken into consideration in planning the system of feeding.

One method is almost universal. Wheat is grown every second year, or every year on half the farm. In alternate years, or each year on the half of the cultivation area not devoted to the cereal crop, is sown rape together with barley or rye. An exception to this system of cropping would be where wheat is grown on a third of the area under cultivation every third year. Where such methods are employed, a little different system is necessary in planning the crop rotation. This allows of fuller use being made of the feed that grows on the stubble.

Occasionally kale or mustard is employed, instead of rape and barley, or, to allow of varying the diet, the fodder crop may consist partly of rape and barley or rye, and partly of kale or mustard. Other fodder crops are sometimes used, but those mentioned are the varieties which are generally employed. Rape has proved a hardy plant, and grows readily in almost any climate; it is not surprising, therefore, to find it so largely grown in Australia. When well fed down succeeding crops grow very rapidly. In certain cases, however, sheep and lambs have refused rape when first placed upon it. But rape mixed with barley or rye, if sown with the drill in alternate rows, has proved one of the best fodder crops for sheep. On rape they fatten readily, while the barley keeps them in good condition and provides the ewe with a plentiful supply of milk, a most important factor in the early development of the lamb.

Feeding Off.

The great point in mixed farming is to reduce waste to a minimum. In districts where the wheat crop is sown early and its forwardness might render it liable to damage from frost, it has been found that if the first growth is utilised as part of the food supply and fed off by the sheep, not only does it stool out better, but is much hardier during its subsequent growth.

Small Sections.

The farmer will probably view with considerable suspicion the statement that the most economical method of feeding off his fodder crops is to make them available in small areas. The drawback to the system is apparent at once, while its many advantages may not perhaps be so readily recognised. The drawback is, of course, that such methods involve a little extra outlay in the erection of fences. These need not be of a permanent character. The cultivation of an area subdivided into small sections undoubtedly wastes time and involves more trouble in handling teams and machinery. Dividing

fences of a temporary nature would serve the purpose just as well. These could be removed when the land was required in larger sections next year for the wheat crop.

The outlay necessary for such subdivision may appear unjustified, but any man of experience knows that the extra use which he may make of his fodder will more than recompense him for the additional expense. The extent of the sections must be determined by the size of the flock they are intended to accommodate.

This system of feeding means the complete consumption of all herbages, and admits of the sheep being frequently moved into fresh pastures. The fodder is thus less likely to be trodden down and soured than when sheep are allowed to range at will over a large paddock, in which case a great amount of herbage is allowed to run to waste, all for the lack of a little system.

When this system of feeding comes into force at all, it will generally be along much the same lines. The whole flock, or at least a sufficient number, should be put on each section in turn, and the available herbage fed off promptly and well, and the sheep changed to a fresh section. Thus the stock have the benefit of frequent change, which helps very materially to keep them in condition and allows the succeeding crop time to grow. Sheep, perhaps more than any other class of live stock, require a change of feed, and are apt to sicken if left too long on one kind of pasture. The usefulness of at least a small area of natural grasses as furnishing a still further variety may be repeated and emphasised.

Another good result of moving the flock frequently is that if the fodder crops are allowed to grow too long the full benefit is lost through the sheep treading down more than they eat, and so causing many of the plants to die out. Nothing will keep the succeeding growths sweeter than to be well eaten down and allowed just sufficient time to attain a fair length before being again fed off. Constant cropping in its early stages tends to produce a prompt and vigorous growth.

Hand-feeding.

The number of sheep a farm is capable of carrying in early spring is, of course, no indication of its carrying capacity throughout the year. The common practice of buying in a few sheep each year to eat down the food supplies when they are most plentiful cannot be too strongly condemned. It may look profitable, but the process of forming collections of other men's rejects must result in deterioration of type. The aim should rather be to obtain the best type that will thrive in the district and to endeavour to, at least, maintain if not to raise, the standard of the flock. In the past it has too often been thought that any class of sheep was good enough for the farmer. But if national pride and his faith in the future of the great sheep and wool industry of Australia will not prevent a man from spoiling breeds, and distributing nondescripts, he will speedily find that if he goes in for mixed farming he must keep the highest standard of type possible. That being so, he must be prepared, rather than part with any portion of his flock, to do a certain amount of hand-feeding should occasion arise.

Now if this advice is to be taken to mean the purchase of chaff, oats, or bran at drought prices, it is clearly at fault. It does not mean this, however. Flockmasters who confine themselves to breeding high-class studs may resort to these practices. The farmer must look around for much more economical methods.

By-products.

In the past many growers in other States have depended on the dry spells in New South Wales to get rid, at good prices, of their hay crops. The grazier on a large scale who depends solely on the rainfall is at such times entirely at the mercy of the man who has fodder to sell. The farmer, however, is in a much more secure position because so many of his by-products may be turned to advantage. The cheapness and efficiency of the oil-engine should place it at the disposal of every up-to-date farmer. Its usefulness is almost boundless. It provides power for shearing, pumping, sawing, and, more important from the present point of view, driving a chaff-cutter. Stock will relish, if chaffed, many kinds of feed which they would refuse if not so treated. During prosperous times the value of the various by-products of the farm is apt to be disregarded, but in times of scarcity everything edible must be turned to good account. Dry spells thus often prove blessings in disguise. Under such conditions the policy of the farmer will be one of the strictest economy, and it is during such periods that attention is directed to products which, on the return of good seasons furnish additional profits.

In cereal-growing districts, where the harvester is coming more widely into use, the stubble forms one of the chief of such by-products. As the machine simply strips the heads off the wheat the whole stalk is left behind. Where sheep are not kept this straw is usually either burnt off or ploughed in; but where stock have to be fed this stubble, if gathered, chaffed, and mixed with a little molasses, or something of the sort to make it palatable, forms an excellent standby in times of emergency. This also applies to the utilisation of the "cocky chaff."

Ensilage.

There should also be mentioned a method in which New South Wales has shown the way to the rest of Australia—the conservation of fodder by means of the silo. Every practical man knows the value of ensilage, and how during years and seasons of plenty herbages may be stored up for use in less favoured times. Tons and tons of stuff are still allowed to go to waste on farms and sheep runs within the agricultural areas. Were it possible to conserve the feed available during the spring months in many parts of the State, there would, in a year like the present, be more than sufficient for double the stock at present carried, and that throughout the entire year.

Summary.

The object of the present article is simply to outline methods of feeding and stocking suitable for a system of mixed farming.

In our next we propose dealing with principles of breeding and the wide question of type. The whole of the present paper may be summarised somewhat as follows:—

> Increasing population and increased demand for land and the consequent rise in land values call for subdivision and closer settlement; closer settlement demands a system of mixed-farming; mixed farming means for New South Wales a combination of sheep and wheat; and sheep and wheat necessitate alternative methods, together with due attention to fodder crops and full utilisation of all by-products.

Destruction of Saltbush by Insects.

In consequence of the reported destruction of saltbush by insects in the neighbourhood of Hay, the Entomologist visited the district. Under the guidance of the District Surveyor, Mr. Scrivener, and other gentlemen familiar with the country, Mr. Froggatt was enabled to examine a very large tract of the infested areas.

There are some hundreds of thousands of acres upon which the whole of the saltbush has been completely denuded of its leaves, and in many cases, particularly on the higher land, the plants are dead. Mr. Froggatt was informed that some months ago the whole of this country was swarming with caterpillars which cleared the leaves off the bushes. He found in the soil under the bushes a great number of pupæ of two different moths that had done the damage, and secured a large number to breed out so that the species can be identified.

The denuded saltbush was later on attacked by the larvæ of a beetle or weevil, and an immense number contain the larvæ or pupæ which are the final cause of much of the saltbush dying. In many places a web-spinning spider has become so numerous on the plains that every dead bush is covered with fine web, so that in the early morning, or when the sun is low, the miles of web-covered bush has a most remarkable appearance.

While there is a great deal of the bush quite dead, some of the plants which have been attacked by caterpillars only are showing signs of life, and if summer rains come in good time, they will probably recover. In the meantime, some hundreds of thousands of acres are apparently covered with dead twigs, and an immense amount of valuable stand-by fodder has been destroyed.

Mr. Froggatt regrets to add that nothing can be done as regards dealing with these pests on such a large area, but from observations made, he is of opinion that on the plains a large proportion of the moth pupæ are infested with an ichneumon wasp, many of which were flying around while he was digging out the pupæ. These natural parasites will probably destroy a great number of the pests before the next broods mature.

The occurrence of this pest grimly emphasises the difficulties that may be expected to follow on the destruction of insectivorous birds.

Derangements of the Digestive Organs in Horses.

Most derangements of the digestive organs in horses are due to errors in diet, and a good and regular system of feeding will do more to prevent digestive disease than anything else that can be suggested.

The following rules for feeding are generally accepted as correct:—

1. Water before feeding, and not for at least an hour after.
2. Feed in small quantities, and often.
3. Don't work hard immediately after a full feed.
4. Never give a horse food in large quantities to which it is not accustomed.

If the above rules are followed, and care taken to ensure that only sound, good food is fed, very little trouble will be experienced.

It is extremely difficult to differentiate between the various gastric and intestinal affections in the horse, and most complaints seem to be placed under the head of colic. The name is given to a train of symptoms which horses show when they have pain in the abdomen. The pain may actually be due to a variety of causes, but the symptoms exhibited are often similar. Colic, as defined above, may be due to bolting food, unsuitable or improperly prepared food, sudden changes in diet, a surfeit of green fodder, defective teeth and consequent imperfect mastication, watering or working severely immediately after feeding, too much food at a meal, or intestinal parasites. In the horse we distinguish two forms of colic, viz., spasmodic and flatulent.

Symptoms.—Spasmodic Colic.—The pain is not continuous, but there are intervals of ease between the spasms, during which the animal appears quite well until another spasm suddenly occurs. The animal is generally violent, paws, stamps, kicks at its belly, lies or throws itself down, rolls, crouches in the loins when walking, stretches itself out as if trying to urinate, looks round at the sides, sweats either in patches or all over, the pulse is fast, the breathing hurried and distressed, the mucous membrane of the eye is red, but the temperature remains normal. Between spasms the animal appears quite well, and will start feeding if allowed. As the attack progresses, the pains get more frequent and longer, and the intervals free from pain shorter.

The bowels are constipated, as a rule, and if the animal passes any dung, it would only be a very small quantity.

Treatment.—Walk the animal about, and on no account permit it to lie down or roll. Give the following drench at once:—

Oil of peppermint, 1 drachm.
Aromatic spirits of ammonia, 2 ounces.
Linseed oil, 1 pint.

Keep well shaken, and drench slowly.

If relief is not obtained in an hour, repeat the mixture, substituting thin gruel for the linseed oil. This may be repeated till three doses have been given, at intervals of an hour. Apply hot fomentations to the abdomen for

period of half an hour at a time, keeping the temperature of the water so high that the hand cannot be kept in it—half cold fomentations are quite useless—or mustard mixed sloppy in a basin with vinegar may be rubbed over the belly. Give copious enemas every hour. If, in spite of this treatment, the animal is still not relieved, give the following drench, repeating, if necessary, every three hours :—

Chloral hydrate, 1 ounce.
Thin gruel, 1 pint.

Flatulent Colic.—This is due to fermentation of the food in the bowels, which become distended by the resultant gases. The belly is inflated, giving the animal an unnaturally round appearance, and the pain is continuous, though not so violent as in the spasmodic variety. The animal does not throw itself about so much, but appears somewhat sleepy, though uneasy and fidgety, scraping, wandering slowly round, attempting to lie down, but afraid to do so.

Treatment.—Give the following drench at once :—

Oil of turpentine, 2 ounces.
Aromatic spirits of ammonia, 2 ounces.
Linseed oil, 1½ pints.

Shake the drench very frequently whilst giving.

Walk about and give enemas and fomentations as in spasmodic colic.

If the pain is not relieved in two hours, give an ounce of oil of turpentine in a pint of thin gruel, and repeat again in two hours if necessary. If still not relieved, give the chloral hydrate as in spasmodic colic. Relief is indicated by the free passage of wind and fæces.

As an after treatment, when the pain has subsided, feed the animal on bran mashes for twenty-four hours. It is also best not to work the horse for two or three days.

In drenching, if the animal struggles, or attempts to cough, immediately lower the head. A portion of the drench may be wasted, but unless this is done, the fluid will be likely to pass down the windpipe, and the horse eventually die of pneumonia.

[This article is published as inquiries on the subject have of late been frequent from horse-owners who are resident far distant from any veterinary aid.--S. T. D. Symons, Chief Inspector of Stock.]

The Dairy Industry.

The Manufacture of Butter.

M. A. O'CALLAGHAN.

In New South Wales, and for that matter in Australia, the basis of the dairying industry is that section which comes under the heading of butter manufacture, and while considerable revenue is derived from cheese-making and from the production of milk for sale as milk, still the industry must depend for its future mainly on the place which the State of New South Wales will take in catering for the butter markets of the world, and especially for those markets outside Australia.

Butter manufacture.

The principles of butter manufacture are the same, no matter in what part of the world the butter is being made, whether at the equator or within the arctic circle. Different machinery is of necessity used to bring about the required conditions as governed by the principles referred to. Factory butter-making has now become an almost universal industry; and so general is man's opinion on the quality of butter that it really matters very little whether the butter is being made for use in Australia, in South Africa, in England, America, or in Egypt, the consumer required, practically speaking, the same class of article. The introduction of machinery into the dairying industry has helped to do away with all parochial tastes and requirements in the way of special flavours, special colours, or special salting in butter, and now the makers, whether they live in Canada, in Denmark, in Siberia, in the Argentine, or in Australasia, are working with exactly the same object in view, viz., to turn out an article which will have the flavour peculiar to butter made from ripened cream, and which will be uniform in make.

Commercial requirements.

For commercial purposes a butter is valuable according to its flavour, its texture, and its general appearance, and in classifying butter these sections are generally rated as follows:—

Flavour	50 points.
Texture	30 „
Condition, including colour, salting, and packing ...	20 „

Such a high part do smell and taste play in man's food requirements that flavour, as is seen, practically speaking, commands the quality of the butter. Texture comes next, but this, although a very important item to the manufacturer, is not quite so important to the consumer, because if the texture

is inferior when made, the great probability is that the butter will have deteriorated in flavour considerably before it reaches the consumer, and thus the latter will still judge the butter mainly on its taste and smell. The condition and appearance of the butter have a good deal to do with its sale, and also a good deal to do with the appetite of the consumer, because no matter how well-flavoured a butter may be, if it is put up in a condition displeasing to the eye, it will not attract any but a hungry person towards its consumption. Nowadays, however, as dairying is carried on under proper manufacturing conditions, it is rare to find a butter of an appearance so bad as to be unpresentable at table. When such a butter comes along, the commercial man usually classes it as "pastry," no matter how good it may be in flavour and texture.

Practically speaking, creamery butter in New South Wales is manufactured from cream that has been delivered at the butter factory by rail, boat, or waggon, through the agency of either a public or a private carrier. Our managers are not, therefore, in the same favourable position regarding the control of the fermentation as are their competitors in other parts of the world, who receive the milk twice a day during the summer months, and, therefore, obtain the raw product before any fermentation of consequence has taken place. Hence, the factory manager in this State must rely on his ability to select superior creams from those that are inferior, in order to enable him to manufacture a high-class butter; in other words, he must be a sort of cream connoisseur or he will undoubtedly fail in his effort to make a butter of good flavour and of superior keeping qualities.

Flavour.

By flavour is understood the aroma and the taste which we obtain on tasting and smelling a butter, judged in somewhat the same way as the connoisseur judges his wine, and as it has been shown that 50 per cent. of the total marks awarded in the judging of butter are allotted to flavour, and as, further, the flavour of the butter will depend on the cream from which it has been manufactured, the first step of importance which the manufacturer has to take on the arrival of the raw product is to classify the cream into grades according to its quality. In order to do this successfully, he must first of all be capable of differentiating between that flavour which is due to a *bacterial agency,* and that which may be due to such items as the *food* or *water* which the cattle have consumed. This is a matter of great importance, and for this reason: the taints or peculiar flavours which are given to milk, and hence to cream, by the flavouring oils contained in the food which the animal receives do not get worse on the butter being held, and therefore such taints will not cause a further deterioration in the flavour either of the cream or of the butter; but if, on the other hand, an inferior flavour is due to the action of micro-organisms, then the cream-grader must know that unless checked by some artificial means these ill flavours will continue to increase and may even be superseded by others.

of a worse nature due to fermentations, which will eventually cause the butter to decompose to such an extent that by the time it arrives in England for sale it will be a quality or two lower than it was on the date of manufacture.

By thy cream I shall know thee.

As is the farmer, so is his cream. When the factory manager or his cream-grader takes his place on the grading-floor he does so with the object of separating the good from the inferior, and by the flavour and condition of the creams he judges, and correctly so, the farmer and his management. If a cream which is regularly delivered is tainted by the product of any germ, the factory manager assumes that the farmer is more or less unclean or careless in the management of his business. If, on the other hand, the cream has a taint which is due to the food which the cows have consumed, the manager comes to the conclusion, and rightly so, either that the pastures on which the cattle have grazed are affected by the growth of rank plants or weeds; or that the hand-feed which the farmer is giving his cows is of an unsuitable nature. Generally speaking, the grading of cream in New South Wales, other things being equal, is practically the classification of the farmers according to the cleanliness or uncleanliness of their methods, dairies, and dairy machinery. This brings us to a more detailed analysis of the cause of various taints.

Taints due to other than bacterial causes.

Food of the Cows.—If a cow partakes of any food with a pungent taste and smell, that peculiar taint is immediately imparted to the milk. The essential or flavouring oils of these plants, which are generally called weeds, pass very quickly through the animal system, and the milk becomes affected in the way indicated. As a rule, however, when we have a normal season, the pasture is sufficiently free from these strong-tasting plants to enable our dairy-farmers to get the milk practically free from any injurious food taint. In the spring of the year in some districts we get these food flavours as the result of cattle eating plentifully of what are known as carrot weed, wild mustard, and, to a lesser extent, of trefoil. There is, however, no country in the world probably so free from food taints in its milk and cream as is Australia, and for the reason that the cattle are fed mainly on grass and green fodder plants. The use of turnips, mangels, &c., is practically unknown to the Australian dairyman. Thanks to our climate, we have a distinct advantage in this way over other butter-makers. Our animals are out of doors throughout the whole of the year, and large quantities of root crops, &c., have not to be grown for their upkeep during the long winter. Maize and sorghum take the place in this country which turnips and mangels occupy in the British Isles, and undoubtedly everything is in favour of the former foods.

The use of Oil Cakes.—What are known to the trade as oil cakes, of which linseed oil cake and cocoanut oil cake are the principal, are not largely used

in this country, and hence food taints cannot be attributed in any way to them, though it may be well to bear in mind the fact that while from 1 to 2 lb. of either of these cakes per cow per day is a useful addition to the food ration, any more than this quantity will appreciably affect the flavour and sometimes the texture of the resulting butter.

Flavour due to various odours.—We will now pass on to the other taints which affect the flavour of butter, and under this heading we will first take those distinct odours which are emitted from various foods, and which are capable of being absorbed by the butter fat in the milk or cream. Such substances as fish, fresh meat, onions, apples, &c., if placed in the same room with, or close to, the milk or cream, will impart their flavour to the latter: and whereas such taints do not affect the food value of the butter in any way, they still give it a flavour which is not desired in a high-class butter, and hence affect its quality from that point of view. For this reason, milk, cream, and butter should be kept away from all distinctive smelling substances. In extremely cold freezing rooms the odour of many of these substances is so dulled by freezing that it is not imparted to butter, &c., but this only applies to rooms held at very low temperatures.

Flavour due to period of lactation.—On those farms where it is customary to have all the cows calving at one time, it will be found that the cream produced from the cows when they are nearing the end of their lactation period will not have the flavour which is desired by butter-makers. The milk at this stage is becoming rather abnormal, and unless mixed with the milk of cows that have not been long calved, it will give a cream lacking in that flavour which gives butter its pleasant aroma.

Taints due to bacterial causes.

Butter-makers and farmers should bear in mind that nearly all the changes which milk, cream, and butter undergo are due to the action of microbes, and in fact that the decomposition of all organic matter such as manure, silage, meat, fish, &c., is due to the same agency. It must, however, be remembered in connection with this fact that the decompositions of these various products are due to different species of germs. Butter manufacturers and farmers must also establish the fact thoroughly in their minds that there *are helpful germs just as well as there are injurious ones.* A further classification will also be necessary, viz., that the presence of the germs which are accustomed to cause the rotting of manure and the decay of *meat and fish are foreign to milk,* and it is only through man's incapable management that these latter microbes gain access to milk or cream.

Milk as it is in the udder of a healthy cow and afterwards.

It may be taken for granted that when milk is resting in the udder of a healthy cow it does not contain bacteria of any kind, but immediately it leaves the udder proper, and enters the teat or milk duct, it becomes open to bacterial influences. The opening of the milk duct is sufficiently large

for the entrance of bacteria, and, as a rule, the traces of milk which remain in the milk duct from one milking to another act as a medium in which bacteria grow in these intervals. If the surroundings are very clean the only bacteria that are found in the milk duct of a healthy cow are the germs that might be said to be almost natural to milk, namely, the common lactic acid producing germ which causes the ripening of cream. When the process of milking begins, and the milk leaves the udder and enters the milk duct, the force of milk washes the bacteria that are resting in the teat out in the first few streams, and this is the reason that the first drops of milk drawn from even a healthy cow, as a rule, contain a fair number of bacteria, whereas the milk drawn towards the middle of milking contain practically none. If, then, the first portions of a cow's milk are excluded, and the conditions of milking are nearly perfect, only a harmless variety of atmospheric bacteria should get into the milk pail. As milk leaves the cow's teats, however, it becomes, so to speak, a product of its surroundings. If the milk is drawn by hand, the hands of the milker may not have been clean, and in this way whatever species of bacteria was associated with the uncleanliness on the milker's hands will have gained an early start in the milk. The same may be said of the rubber tubes of milking machines, which, if not well cleaned, are a fruitful source of bacterial trouble. The worst form of contamination to the factory manager after the milk has left the udder, however, occurs in one of the following ways:—

1. The introduction of traces of the animal fæces into the milk-pail direct.
2. The introduction into the milk of germs common to decaying matter in the farmyard.
3. The introduction into the milk of commercially injurious, and possibly pathogenic, germs by the use of impure water in the rinsing of dairy utensils.
4. The dropping from the animal's body into the milk bucket of hairs and portions of dry dirt gathered from some dirty water pool in which the cow had been wading some time previously, the dirt obtained therein having dried.

Bacterial infection after milk has been drawn.

When a cow is being milked, it is a very common thing for her to make a deposit in the milking bails, and it is not the general custom to at once remove this manure. The cow herself may not, if the milker has been very careful, have introduced any traces of the manure into the bucket, but another cow comes along in due course and kicks about a bit, with the result that portions of the unremoved fæces frequently gain access to the bucket, and thus introduce into the milk whatever species of bacteria were present in the animal fæces. Another easy and common method for the introduction of portions of the undesirable secretions is the switching of the cow's tail soon after the animal has passed manure or urine. At one time a great deal of

importance was not attached to contamination of this sort unless the milk was to be utilised for making first-class butter, but since it has been clearly demonstrated that tubercle bacilli are commonly present in the fæces of tubercular cows, it has been evident to all observers that this is undoubtedly one of the worst. if not the very worst, possible source of milk contamination. I do not think that this is sufficiently widely known among dairymen, who, no doubt, will rise to the occasion when they have been thoroughly informed, and endeavour to prevent contamination of this character, especially as it has now been clearly shown that tubercle bacilli are not uncommon in butter.

The introduction into the milk of germs common to the farmyard.

This is a source of milk contamination which is not thoroughly understood by farmers generally, for the simple reason that they do not understand the vehicles on which germs may be carried. It may be stated that the germs introduced into the milk pail under this heading gain access thereto from the atmosphere common in the milking bails. If a wind blows from a heap of decomposing vegetable matter in the direction of the milking bails it brings with it particles of dust or vegetable matter, some of which become deposited in the open milking bucket, and thus it is that the milk takes on the fermentations common to the farmyard in which it has been produced. If no decaying matter is allowed within a considerable distance of the milking bails, and if the bails themselves are kept in a perfectly clean condition, it will not be possible for germs of fermentation to be introduced in this way.

The water supply.

The water supply of a dairy farm may be the means of affecting the flavour of the cream in the first instance. The quality of the water may be so bad (this occasionally occurs during severe droughts, when cattle have to resort to unclean smelling pools for drinking water) as to affect the flavour of the cream by affecting the flavour of the milk even before it has been drawn from the cows, in the same way that a pungent-flavoured plant will affect the flavour of the milk while in the cow's udder. The most common way in which drinking water may affect the quality of the cream is as follows:—The cows wade into ponds, large or small, for the purpose of drinking, and they frequently obtain from these ponds large quantities of mud, which latter, on becoming dried on their coats, drop during the process of milking into the milk cans. This dust carries with it the germs which were present in the water pool, and if such water were of an unpleasant odour, due to the decomposition of organic matter, then undoubtedly the germs introduced into the milk pail would be somewhat of the same species as those which would be introduced if particles of manure from the manure heap were allowed to get into the milk bucket.

Water for cleansing dairy utensils.—As a general rule, the butter factory manager sees that the cream cans are well steamed before being returned

to the carrier who takes them to the farmer. The farmer, in his turn, generally washes them with cold water before using them again, and the water used for this purpose, as well as for the purpose of rinsing the milk pails, must be of the purest obtainable, otherwise the injurious forms of living germs which are always present in inferior water will be thereby introduced directly into the milk, and these in a short time will start injurious decompositions in the cream which has been separated from that milk.

Necessity for cleansing the cow's udder before milking.

The necessity for thoroughly washing the cow's udder before milking will depend entirely on the places where the animal has been accustomed to forage and lie down, together with the condition of the hands of the milker at the previous milking. If the paddock in which the cows have been accustomed to lie down during the night is not clean (and there really are very few paddocks so clean that some of the cows' udders will not be unclean), then the udders should be washed before milking is proceeded with. Also, if cows are allowed to forage in unclean places, especially during times of drought, then undoubtedly it will be necessary to wash the udders before milking. Included in this latter must be the general conditions prevailing in the farmyard during wet weather. As the cow walks to and from the bail, she generally does so on a beaten path, and in wet weather this track is nothing more or less than *a continuous manure track.* The consequence is that she kicks up on to the udder pieces of this contaminated soil, with the result that the udder is unclean by the time milking begins. Another fruitful source of dirt on the teats of the cow, though one not generally associated with contamination in the mind of the farmer, is the unclean condition in which some milkers allow their hands to get during the process of milking. In other words, the damp, dirty hand of the milker coats a portion of the cow's udder with unclean matter, and between milkings bacteria will develop frequently in this matter which sometimes contains a certain amount of milk, and thus we get perhaps the worst form of uncleanliness on the cow's udder, necessitating the washing thereof before milking is proceeded with.

A clean method of milking.

Most uncleanness connected with milking occurs because of the fact that a man prefers to milk with a moist, rather than with a dry hand, and for the matter of that the cow also prefers it, as there is then less friction; and also less chance of irritation should there be any slight cracks or sores on the cow's teats. An easy way to get over this difficulty is to have placed in every cow bail a tin of cheap vaseline to which about 1 per cent. of carbolic acid has been added; the hands of the milker, after having been washed, may be moistened with a small amount of this vaseline, the result being that unnecessary friction and sore teats will be avoided, and there will be no excuse for the milker to have recourse to the dirty habit of dipping his

fingers into the milk pail in order to moisten them as he continues the process of milking. Not alone will this result in clean milking, but it will prevent any contagious form of sore teats being transferred from one cow to another.

Safeguards and protection from bacterial contamination.

So far we have dealt with the various contaminations by which the flavour of a cream may be injuriously affected, and it now remains for us to deal with the means of preventing, as far as possible, the casual contaminations that are certain to occur from time to time despite the very best management.

Pasteurisation.—If the cream could be delivered at the factory soon after its separation, then the factory manager could pasteurise and ripen it by the aid of a "starter," and thus control any early fermentations that may have got under way, due to the presence of the ordinary farmyard bacteria. Under our present conditions of dairying, however, pasteurisation, unfortunately, is practically impossible except in a few favoured instances. Some people believe in pasteurising a sour cream, but this is very like attempting to close the stable door after the horse has disappeared. If the cream is becoming sour, injurious fermentations, if present, will have proceeded too far for their evil influence to be prevented by the ordinary heating of milk. This is the reason why I recommended that pasteurisation should be abandoned when the supply of cream to factories took the place of a milk supply, unless at those factories where they receive the cream before it exhibited signs of sourness.

Cleanliness.—Of course, as will have been gathered from what has been said up to the present, the whole of the industry so far as quality is concerned, practically speaking, lies in cleanliness. If it were possible that every dairy-farmer should understand from a bacteriological point of view the meaning of uncleanliness, then undoubtedly we would be on the high road to better things in the way of perfectly clean dairying conditions. Many of our farmers are models in this respect, but unfortunately their efforts are rendered less valuable by the negligence and carelessness of others in their district engaged in the same industry and who send cream to the same factory.

Lactic acid ferment or "starter," as a protector.

It is well known that a great number of the injurious fermentations to which milk and cream are liable cannot take place while there is a healthy ripening of cream going on, and by a healthy ripening of cream is meant a quick development of lactic acid producing bacteria. Now these latter germs practically act as friends working in the interests of the farmer and the buttermaker so as to enable cream to be delivered at the factory, say, a day old, without containing any injurious taints. As soon as milk has been drawn, as already pointed out, some bacterial development must necessarily take place under ordinary conditions, and if the surroundings are thoroughly

sanitary, the great probability is that the only fermentation of any note which will proceed rapidly is that known as lactic fermentation, or cream ripening. This is brought about through the presence of myriads of lactic acid producing bacteria in the ordinary dairy premises, and these gain access to the milk and perform their characteristic work. If, on the other hand, there is not a very plentiful supply of these friendly germs, or if there is a large supply of injurious germs, the favourable ones may get the worst of the battle and the result will be a cream of bad flavour. Now, whereas the farmer cannot be asked to pasteurise his own cream and ripen it, there is no insurmountable reason why he should not add what is technically called a "starter" to his cream immediately it has been separated. This "starter" is simply a great number of friendly microbe seeds put up in some substance in which they maintain their vigour, and this should be transferred into the cream so that a vigorous ripening or lactic fermentation may be brought about before *any injurious taints can be developed by other species of bacteria.* This is not yet done generally to any extent by farmers, but it has been done by a great many of our factories after the cream has been received by them. The best time, however, to add the "starter" is immediately the cream leaves the separator. In fact, the "starter" could be poured into the cream can before the cream is separated into it, and then the ripening proceeds from the moment that the first drop of cream falls into the cream can. This cream should be stirred occasionally.

Method of obtaining "Starter."—The factory which receives cream from any farmer should be in a position to supply the farmer with "starter" on each day that he sends in his cream. With the empty cream cans could be sent a bottle of "starter," and the farmer should return the empty bottles when he sends in his next lot of cream. The necessary lactic ferment to produce the "starter" at the factory could be supplied by the Government to the butter factory, and, in fact, it has been supplied to factories for some years now free of cost. If this method of inoculating the cream at an early stage with lactic acid germs is brought about, a great improvement must in time result in the general flavour of the cream delivered to New South Wales factories under prevailing conditions.

Consistency of the cream as affecting the flavour.

It is only in the non-fatty or milky portion of the cream that germs grow, and it is from this part of the cream that the lactic acid is formed which causes the souring of cream. If, then, the cream is separated so as to attain a very high percentage of butter fat, it will ripen more slowly than if it is separated so as to contain only a low percentage of butter fat. In the summer time the ripening, as a general rule, proceeds too rapidly, and hence cream should be separated thicker than in the colder periods of the year. If, however, it is when separated too thick, there will not be sufficient milk sugar

left in the cream to enable a healthy ripening to proceed, and we may therefore get other fermentations of an undesirable character. For this reason it is not wise to separate cream so that it will contain more than about 46 per cent. of butter-fat. On the other hand, it is a great mistake to separate very thin cream in the summer time, because souring will then proceed too rapidly, and after this healthy souring is developed to a certain extent it ceases, and it *is then that bad decompositions set in and take effect before the cream can be churned.* It is on this account inadvisable in this climate to churn cream containing less than about 33 per cent. of butter fat, and in fact this is only a winter standard; in the summer time from 40 to 45 per cent. of butter fat in the cream is preferable.

The age of the cream as affecting the flavour.

No matter how well the farmer may do his work, and no matter how well the factory manager may perform his part, if the cream has been held too long it will undoubtedly contain the products of injurious fermentations. Reason: lactic acid development proceeds vigorously up to a certain extent, as already pointed out, and in the summer time this limit is reached within from eighteen to twenty-four hours under ordinary circumstances, but when this stage is passed, other and injurious fermentations set in, and *during the next twenty-four hours the cream is constantly deteriorating.* This is the reason why a daily delivery of cream in the summer is *not only advisable, but necessary* under ordinary conditions, if high-class butter is to be manufactured. In the winter time, ripening and other fermentations proceed much more slowly, and hence cream may be held longer without seriously prejudicing its chance of being manufactured into a high-class butter, provided thorongh cleanliness is observed.

Paying for cream according to its flavour.

In New South Wales cream is paid for according to the percentage of butter fat which it contains, but unfortunately all our factories do not pay for the cream according to the *quality of same,* or in other words, according to the quality of the butter which is capable of being manufactured therefrom. Over competition for cream, even among co-operative factories, causes weak factory managers and directors to pay as much per lb. of butter fat for cream that will make a second quality butter as is paid for that which will make a first quality or a superfine butter. There are only two ways by which this can continue to be done; either the farmers supplying the first quality cream are robbed so as to make up the money which the other man's inferior cream is not worth, or the butter-fat tests of those who supply the second quality cream are manipulated so that the farmer, while being paid more for the cream per lb. of butter fat than it is worth, is not paid for *every pound of butter-fat* in that cream. In other words, the test is cut down below its actual result, whereas the price is raised above the actual amount which the butter made from that cream is worth. This is probably

the weakest point in the whole of the manufacturing side of the dairy industry. So seriously was the danger of this becoming general looked upon in a sister State recently, that law was suggested at the instance of a number of co-operative factories. The legal measures suggested provided for—

1. The compulsory grading of all cream according to its quality;
2. The inspection of the books of all factories, so as to see that cream was paid for in accordance with the grade which it received.

These recommendations have not yet been made law, but there is no doubt but that if this pernicious custom continues, it will be necessary to bring about throughout Australia some such protection for the industry and for the first-class farmer as that which would be afforded by the legal measures above suggested.

(*To be continued.*)

Culture Media for Butter Factory Managers.

The Manager of the Lismore Co-operative Dairy, Mr. A. A. Taylor, has suggested that it would be a great assistance to him if the Department could supply the necessary media for bacteriological work. He would gladly undertake to defray any expense thus incurred.

The Dairy Expert reported, in connection with the matter, that this is a matter that might be undertaken by the Department of Agriculture with great advantage to dairy factory managers, many of whom have qualified themselves by availing of the special instruction in this direction at the Dairy Science Schools, conducted by the Department in different districts, to carry out simple bacteriological tests.

Arrangements have accordingly been made with Messrs. Donald Ross & Co. (Ltd.), Angel-place, Sydney, to supply culture media in flasks, which it is thought will prove more convenient than tubes, because the latter are liable to breakage, as well as being more expensive. Flasks of sterile gelatine medium, containing fifty cubic centimetres, equal to twelve tubes, will be supplied for 3s. each. Flasks containing 100 cubic centimetres, equal to twenty-four tubes, will cost 4s. 6d.; 200 cubic centimetres, equal to fifty tubes, 7s. 6d.; 400 cubic centimetres, equal to 100 tubes, 12s. 6d., whereas tubes would cost 6d. each.

Factory managers obtaining the medium in flasks can sterilise their own tubes and fill them from the flasks, or if extreme care be observed, one might pour a little of the medium from the flask into the plate, and then inoculate with cream, though the former is probably the better course to adopt in the atmosphere of a dairy factory, because when the flask is once opened it is liable to contamination, and hence it would be better to fill all the tubes direct from the flasks at once, and use then as required.

The Department could supply all the necessary media, but the Minister prefers not to compete with private firms in any commercial articles.

Milking Trials at the recent London Dairy Show.—Success of the Lincoln Red Shorthorn Breed.

The performance of the Lincoln Red Shorthorn cow, Burton Nancy 5th, the property of Mr. John Evens, of Burton, was a rather remarkable one. In addition to obtaining first prize in her own class, she won the Barham Challenge Cup, open to all breeds, for the cow gaining the greatest number of points in the milking trials, and the Lord Mayor's Challenge Cup, for the cow gaining the most points above the standard of her individual breed. She also won first prize and silver medal in the butter test, open to all types of Shorthorn cattle.

Her yield was as follows:—

On the first day she gave 33·5 lb. of milk in the morning and 29·6 in the evening.

On the second day she gave 33·5 lb. milk in the morning and 28·2 in the evening,

or an average of 62·4 lb. milk per day.

This was a big yield, but was not the most remarkable point in connection with the performances of this cow, as the milk tested at the extraordinarily high rate of 4·49 per cent. of fat in the morning and 5·23 per cent. of fat in the evening—a phenomenal result for a cow yielding such a large quantity of milk. The solids not fat in the milk averaged 8·79 in the morning and 8·61 in the evening. The average amount of butter-fat yielded each day was 3·01 lb., which on being turned into commercial butter would work out at about 3½ lb. per day.

A second prize Lincoln Red Shorthorn cow, also the property of the same owner, averaged 27·3 lb. milk in the morning and 26·1 lb. in the evening, with a fat test of 3·07 in the morning and 4·06 in the evening.

Burton Nancy 5th shows all the lines of an extremely heavy milker. The wedge shape is developed to an extraordinary extent, the flat thigh and cut-away highly-arched flank, which are characteristic of the big milker, are here very evident. The milk veins also stand out in a very prominent fashion.

As Lincoln Red Shorthorns have recently been imported into this State, the record of this cow, together with a record of the herd represented by her, given on p. 25, should prove of considerable interest.

A notable Devon Cow.

At the same exhibition the Spencer Challenge Cup for cow gaining the greatest number of points by Inspection, Milking Trials, and Butter Test, was awarded to the South Devon cow Fancy, 12 years 2 months of age, by Prince from Dairymaid, bred at Paignton, Devon.

Fancy was first by Inspection, first in Milking Trials, and highly commended in Butter Test. Her milk yield for twenty-four hours was 54 lb., and it gave 2 lb. 5¾ o. butter.

Herd of Lincoln Red Shorthorns.

The following are milk records of the cows that calved during 1908 belonging to Mr. John Evens, Burton, near Lincoln. The milk is weighed twice daily. The cows are Lincoln Red Shorthorns, entered in the Herd Book of the Lincoln Red Shorthorn Association :—

Name of Cow.	Date of Calving, 1908	Calf.	Total yield in lb.	Days in Milk.	Average per day.
Fuchsia 2nd	13 January ...	4th	8,004	245	32·7
Cowslip Red 4th	16 ,, ..	3rd	7,846	287	27·3
Ruby Spot	22 ,, ...	8th	11,424	287	39·8
Fillpail	22 ,, ...	3rd	7,909	252	31·4
Tulip 3rd	14 February...	4th	5,411	217	24·9
Milker	5 March ..	3rd	15,081	413	36·5
Fuchsia 3rd...	5 ,, ...	2nd	9,685	308	31·4
Fuchsia	25 ,, ..	7th	8,723	294	29·7
Carter	27 ,, ...	2nd	6,250	294	21·7
Plenty 3rd	31 ,, ..	3rd	6,979	280	24·9
Cork 5th	1 April ...	1st	9,280	357	26·0
Pride 7th	2 ,, ...	2nd	7,831	287	27·3
Tozzle	15 ,, ...	4th	11,256	343	32·8
Cork 3rd	23 ,, ...	5th	7,646	182	42·0
Royal Maid 2nd	24 ,, ...	3rd	5,484	252	21·8
Bounty 4th	1 May ..	5th	6,832	259	26·4
C. Star 6th	3 ,, ...	3rd	6,446	266	24·2
Violet	5 ,, ..	6th	10,970	350	31·4
Cork 2nd	7 ,, ...	8th	8,214	281	28·6
Fleet 2nd	11 ,, ...	7th	9,382	308	30·5
Beauty 2nd...	13 ,, ...	3rd	11,739	343	34·2
Quality 5th...	19 ,, ...	1st	5,629	287	19·6
Fleet 4th	24 June ..	4th	6,621	224	29·6
Fillpail 2nd...	25 ,, ...	3rd	7,134	238	30·0
Dolly 2nd	27 ,, ..	7th	9,240	280	33 0
Ruby Spot 3rd	3 July ...	3rd	7,148	249	28·7
Ruddy 5th	5 ,, ...	4th	10,601	343	31·0
Potentilla 3rd	13 ,, ...	4th	6,794	287	23·7
Ruby Spot 2nd	27 ,, ...	5th	7,328	266	27·7
Quality 3rd...	8 August ...	5th	8,050	280	28 8
Spotted 5th...	11 ,, ...	3rd	9,191	322	28·6
Maiden	16 ,, ...	3rd	8,630	288	30·5
Maiden 2nd...	24 ,, ...	1st	6,377	280	22·8
Ruby 12th	25 ,, ...	1st	7,179	301	23·9
Profit 3rd	30 ,, ...	2nd	8,612	301	28·6
Plenty 5th	1 September.	1st	6,254	252	24·9
Nancy 4th	1 ,, ...	5th	9,641	294	32·8
Nancy 3rd	6 ,, ...	3rd	5,666	193	29·3
Quality 4th	7 ,, ...	1st	5,613	259	21·6
Nancy 5th	18 ,, ..	4th	7,403	231	32·0
Milkmaid	1 October ...	1st	6,520	217	30·0
Peeress	6 ,, ...	1st	6,270	322	19·5
C. Star 3rd	22 ,, ...	9th	10,638	340	31·4
Burton 8th	26 ,, ...	2nd	7.246	287	25·2
Fuchsia 4th...	7 November.	1st	6,031	287	21·0
Maiden 3rd...	10 ,, ..	3rd	9,227	300	30·7
Fox 3rd	16 ,, ...	3rd	7,729	273	28·3
Lady Burton 2nd	13 December .	2nd	8,375	287	29·2
C. Star 2nd...	19 ,, ...	9th	10,438	266	39·3
Rose 9th	30 ,, ...	1st	7,489	266	28·2

Fifty cows yielded 405,466 lb. milk. Average per cow, 810$\frac{9}{10}$ gallons. Twenty per cent. of these were first calf heifers.

Other Shorthorn Cattle.

Although the breeding of pedigree Shorthorns for dairy purposes is an extremely precarious thing, owing to the fact that though a man may mate a heavy-milking pure-bred Shorthorn cow with a pure-bred sire descended from a good milking mother, still he will not get a heifer which will turn out a good milker once in five times. The predisposition of the Coate's Herd Book Shorthorn cow to lay on flesh is so great that the pure-bred Shorthorn heifer generally comes to the dairy showing the shape of a beef rather than of a dairy animal, and the results are in keeping with the shape. No doubt there are numerous instances of pure-bred Shorthorn cows giving large quantities of milk, but the whole trouble is to get them to reproduce their kind in the direction of milk when mated with a pure-bred Shorthorn sire; though, if mated with a pure-bred sire of another breed, there seems to be no difficulty in getting from the same cow a first-class milking heifer—cross-bred, of course.

The non-pedigree Shorthorn cow Daisie was reserve to Burton Nancy 5th for the Barham Cup, and first for the non-pedigree Shorthorns in the milking trials. Her milk averaged 34·7 lb. in the morning and 29·0 lb. in the evening. Her test was low when compared with that of the Lincoln Red cows, Burton Nancy 5th testing 3·85 per cent. of fat in the morning and 3·72 per cent. of fat in the evening, with a total amount of fat of 2·41 lb. for the day. This cow (Daisie) shows Shorthorn lines generally, but there is not any doubt but that there is a stain in her pedigree, like many of the best milking cows of Shorthorn type in England. She resembles very closely the Illawarra type of Shorthorn so famous in New South Wales. Contrast these two cows, Burton Nancy 5th and Daisie, with the Shorthorn cow Heather Queen 3rd,* that won first prize for dairy Shorthorns on inspection. The other cows won their awards as the result of practical trials, but in the case of the Shorthorn Heather Queen 3rd the judge first demanded Shorthorn type, and milking qualifications afterwards. Now it is this type of cow that I refer to mainly when I say that the pure-bred dairy Shorthorn lacks, as a general rule, dairy type, and in my opinion also lacks ability to yield a large quantity of milk. She may yield a large quantity of milk for a short time, but, generally speaking, this type of cow does not maintain a fair milk yield for any length of time. The remarks of the writer of the report appearing in the *Live Stock Journal* concerning this cow are rather interesting. He describes her as a handsome, big frame, typical dual purpose cow, carrying a beautifully shaped and capacious udder, yet sufficiently well fleshed to uphold the character of the breed. This cow gave 41 lb. 3 oz. of milk on the first day of the trial, but I would not like to guarantee that she would give a payable quantity of milk from season to season, or that any of her calves, if she were mated with a pedigree Shorthorn bull, would be large milkers. We have reached the stage in dairying when we have little room for the dual purpose cow, and unless she is a dairy cow first her other good features are of small account.—M. A. O'CALLAGHAN.

* Unfortunately, the only photographs of these cows available were found to be unsuitable for reproduction.

Some hints on the Manufacture and Marketing of Chaff.

A. H. E. McDONALD, Instructor in Agriculture, Hawkesbury Agricultural College.

In the manufacture of chaff for market, considerable skill and care are required in the selection of the crop, handling in the field, and in the actual chaff-cutting. Good quality is important at whatever time the chaff is put on the market, but is particularly so when supplies are heavy. Owing to the bountiful harvests and, consequently, heavy stocks during the present year, much careful attention will be necessary to ensure profitable returns. The expense of placing chaff upon the market is heavy, ranging between £1 10s. and £2 per ton for all charges, and when the food material is inferior, little profit is made by the farmer. That skill and carefulness are required in making chaff is evident from the high returns which men of experience obtain, in comparison with those of other makers. In the City markets the best makers are known, and the consistently good quality of their chaff indicates that their success is due, not to chance, but to the skill exercised in its production. The secret lies very largely in the fact that these men understand the requirements of buyers and endeavour to meet them.

Mr. O'Neill (Messrs John See & Co.) giving the senior students of the College instruction in the selection of chaff.

(Photo by Mr. Musson.)

Deficiency in quality may result from carelessness in manufacture, or may be due to inferior hay. The first can be prevented, but good chaff can never be made from poor hay, and it is better to keep it upon the farm, as the returns from chaff will not adequately recompense the outlay and trouble involved in its production and marketing. The qualities which are required by buyers may be briefly classified as colour, smell, length, cleanness of cut, fineness, softness, amount and condition of grain, freedom from dust, weight, and general make up for market.

The colour is one of the most important points, and with smell has the greatest weight with buyers. In wheaten chaff a green colour is essential, but in oaten this is not so necessary, as a more strawy colour is allowable; a slight purple renders it still more attractive. The colour is taken to indicate quality, and only hay which has it should be selected for chaff-making. When feeding the hay into the chaffcutter the bundles which are below the standard in this respect should be thrown aside and used for other purposes. In New South Wales chaff is made almost entirely by the farmers who grow the crops, but in some of the other States mills have been established where hay is treated in large quantities. By a proper system of grading at these mills uniform samples can be maintained, whereas in this State great divergencies in quality exist. When curing in the field some of the sheaves become bleached, and in unfavourable weather large quantities may be damaged. Owing to the different qualities which thus arise it is profitable to the farmer to grade his hay so that the different sorts can be kept separate. The inclusion of inferior stuff reacts on the whole, and instead of the good grading the bad up, the poorer material reduces the value of the good. Where different grades are made a high price is realised for the best, and a fair price for the remainder. The value of the good suffers in two ways when inferior stuff is mixed with it. The discoloured chaff lowers the appearance, and knowing by past experience how frequently chaff has been adulterated with straw and other substances, the buyer is suspicious and may reject what is really good stuff, containing only a small amount of discoloured material. Occasionally in running hay through the chaffcutter it happens that a quantity of bad stuff goes through and causes one or more bags of inferior chaff amongst a large number of good ones. This is very liable to happen when cleaning up, and if these bags are included with the good, and are sampled by a buyer, it inevitably means that his estimate of the value is reduced. To avoid these risks it is necessary that competent trustworthy men should feed the hay into the machine.

The point to which the greatest attention is paid in chaff, and which is the chief factor in the determination of its value, is the smell. It should possess that sweet aromatic odour which is immediately recognisable. The slightest mustiness is noticeable and the value is affected in accordance with the degree. Some chaff when badly affected has an extremely objectionable smell, whilst in others it can scarcely be detected. If the hay has become musty or mouldy in the stacks it should not on any account be made

into chaff for market except, perhaps, under exceptional circumstances Chaff, however, may sometimes become musty although made from prime hay. Steaming is adopted by most good makers to facilitate cutting, but when done carelessly it may cause deterioration. The process is done by running the sheaves through a long tube into which dry steam is led, but when the pressure becomes too low, some of the steam condenses and the moisture lodges on the hay. When the chaff is pressed into bags the presence of this moisture induces fermentation, and mustiness results. The remedy is to see that a proper steam pressure is kept up so that the hay will be subjected to dry steam only. Sometimes at the end of a day's work the tube, which holds a number of sheaves, is left full, and during the night moisture condenses on to the hay and renders it quite moist. On starting next morning the chaff from these is run into one or two bags which becomes musty, and these if noticed by buyers when sampling will do much harm. The exposure of the hay too long to even dry steam may result in the same trouble. Prime chaff may also become musty in the bag when it is stacked for long periods in large stores. Such chaff can always be recognised by expert buyers, and is frequently rejected in favour of fresher samples. Inferior chaff is likely to deteriorate through this cause, especially when put on a glutted market, as sometimes it has to be held a considerable time before it can be moved off.

A good deal of latitude is allowed in the length of cut; but, speaking generally, about one-half to five-eighths of an inch is preferred. Greater importance is attached to clean cutting by many buyers, who give it a value next to smell. Faults in this respect are the presence of very short fine pieces or long bits of broken straw. The trouble is usually caused by bad feeding, blunt knives, defective screening, or brittle hay. All of these causes can be removed, and by adopting the proper methods a good clean sample obtained. When chaff contains many long pieces its value is lessened, as horses, in eating it, will in nearly every case reject the long straws, which are pushed aside in the manger. Nothing will induce them to eat these, and as buyers do not care to lose in this way, the result is that no more of that brand is purchased. Blunt knives will cause a badly-cut sample, and they must be kept well sharpened. Bad feeding is a prolific cause of trouble. The hay must come under the knives in a firm compact body, and it is so only when the feed-box is kept full. If it is allowed to become partly empty the straw springs away from the knives and is broken instead of cut. Hay grown in a hot, dry climate is generally brittle and difficult to cut properly, as it breaks under the knife into small particles; this may also occur in hay grown in cool climates. To overcome this difficulty the stems are toughened before cutting by steaming. Hay treated in this way gives chaff a much improved appearance, and which sells more freely than that which is untreated.

Whilst many men, especially farmers or country users, like to see developed grain in wheaten chaff, its presence is not desired by city buyers. They

prefer chaff made from hay cut at such an early stage that grain has not formed. The reason for this is that chaff which contains grain is drier and more indigestible and liable to cause colic. It is well known that wheat, unless boiled or soaked, is harmful to horses, and for this reason some buyers do not like to see it in chaff. Green chaff is more laxative, and in the city, where greenstuff is not always obtainable to keep the bowels of the horse open, it is preferred. In oaten chaff, on the other hand, the presence of grain is welcomed, as its value as feed is recognised. In the country, where green feed is usually readily obtainable, the presence of grain in wheaten chaff is not so objectionable, but even there it is doubtful whether it is desirable. Its presence is a certain indication that the crop has not been cut until a late stage of its growth, and the disadvantages of such a course have frequently been pointed out in these pages.

Cleanness is a point to which much attention should be given. It means freedom from dust of all kinds, moulds, and weeds such as wild oats, spear grass, barley grass, dandelion, saucy jacks, and many others. These are all more or less objectionable, some having such a bad effect upon the chaff that it becomes extremely unpalatable to horses. Land intended for hay crops should be kept perfectly clean by proper cultivation and rotation, as it is only by following such a course that clean chaff can be obtained. It is a fallacy that crops which are too badly infested with weeds to be suitable for grain can be profitably marketed as chaff. The presence of any weeds whatever makes the buyer suspicious, and low prices are given for chaff containing them. Smut in crops is a cause of dirtiness, as also is the presence of mice dung. Most of the dust can be removed by proper screening arrangements, except when the hay is very dirty.

The weight of a bag of chaff varies from 80 to 112 lb., the heavier weights are usually made to effect a saving in bags, but it is questionable whether it is not false economy. Only a few bags are saved per ton, and the extra price obtained for a ton of light bags generally more than offsets this saving. Much of the chaff bought in the market is retailed at so much per bag, and, when a retail buyer is purchasing, one bag is much the same as another, and usually a higher price weight for weight is obtained for light bags than for heavy ones. Another objection to heavy bags is the danger of mustiness occurring in them. When damp or fresh chaff is tightly compressed fermentation is induced, but in loosely-packed bags the air circulates more freely, and mustiness does not occur.

A good appearance has an important influence with the buyer, and to secure it only new sound bags should be used. Soiled second-hand bags seem to indicate careless handling and inferior produce, and the buyer becomes prejudiced at the first glance. The best kind of bag to use is that known as the 20-oz. bran bag. It is sufficiently strong to stand handling in transportation, and has, when properly filled and sewn, an attractive appearance which invites inspection.

At the Hawkesbury Agricultural College the students receive special practical instruction in judging fodder and foodstuffs as well as live stock. The illustration, p. 27, will serve to afford some idea of the way the classes are conducted, and the score cards reproduced below indicate the points that students are trained to observe.

STUDENT'S SCORE CARD.

Oaten and Wheaten Hay.

Scale of Points.	Maximum Points.	Student's Estimate.	Instructor's Estimate.
1. Colour—Bright green preferred (according to market requirements).	16	....	....
2. Smell—Fresh, sweet, appetising; free from mustiness.	20	....	....
3. Fineness of stem (for variety submitted)	8	....	....
4. Softness of stem, not harsh or brittle	12	....	....
5. Amount and quality of leaf	8	....	....
6. Amount and condition of grain (ripeness according to market requirements).	10	....	....
7. Cleanness—Freedom from dust, moulds, and impurities.	18	....	....
8. Weight and general make up for market . ..	8	....	....
Total	100	....	....

No. of Sample..... ....

Name of Student .... Variety.. ....

Date ....

STUDENT'S SCORE CARD.

Oaten and Wheaten Chaff.

Scale of Points.	Maximum Points.	Student's Estimate.	Instructor's Estimate.
1. Colour—Bright green preferred (according to market requirements).	12	....	....
2. Smell—Fresh, sweet, appetising; free from mustiness.	20	....	....
3. Length and cleanness of cut	16	....	....
4. Fineness and softness (for variety submitted) ...	10	....	....
5. Amount and condition of grain (ripeness according to market requirements).	8	....	....
6. Proportion of stem to leaf	8	....	....
7. Cleanness--Freedom from dust, moulds, and impurities.	16	....	....
8. Weight and general make up for market	10	....	....
Total	100	....	....

No. of Sample......... ....

Name of Student .... Variety.............................

Date ....

A Suggested New Industry for New South Wales Farmers.

Cultivating the Snapping Turtle of Japan (*Trionyx japonicus*, Schlegel).

DAVID G. STEAD, Naturalist to the Board of Fisheries for N.S.W.

For some time past consignments of Japanese fresh-water turtles have been imported alive into this State for consumption in Sydney, where, to a certain extent, they are taking the place of the large marine Green Turtle so largely used in the preparation of "turtle soup."

As there appears to me to be no valid reason why these esculent reptiles should not be farmed by our own people, and in our own country, the following notes upon the species are furnished with a view to assisting those who might entertain the thought of embarking in the enterprise, as well as for general information.

The Snapping-Turtle, or Soft-Shell Tortoise of Japan, is one of the so called "Soft-River Tortoises," which are confined to the rivers of the warmer regions of Asia, Africa, and North America. The most striking feature of these reptiles is to be found in the nature of their shells, which, unlike the common fresh-water turtles of our rivers and lagoons, are quite devoid of horny shields, and are very imperfectly ossified, being, more particularly round their borders, quite soft and flabby. Externally, also, they are characterised by their long necks, which, together with their heads, can be completely withdrawn into the shell, and also by the proboscis-like snout and the thick fleshy lips concealing the jaws.

These Snapping-Turtles are able to stay for many hours at a stretch under water; and I am convinced from my observation of one specimen in captivity recently that they are able to oxygenate the blood from the water direct, as I have witnessed in an aquarium the water passing slowly in and out of the nostrils, each outward movement of the water being accompanied by a spasmodic action of the lower jaw. This is a most remarkable adaptation of Nature to suit the very peculiar existence of these strange animals. They grow to a length of as much as 16 or 18 inches, though they are usually smaller.

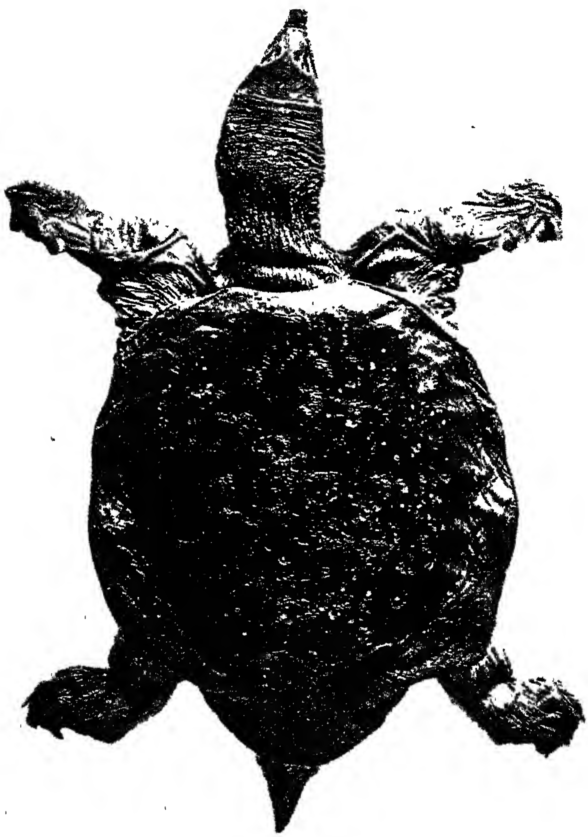
The Snapping Turtles occur naturally in Japan, but their present abundance there is solely due to artificial culture. The place occupied among gastronomical delicacies by the Diamond-back Terrapin in America and by the Green Turtle in England, and also in this country, is taken by the Suppon (as the Snapping-Turtle is called) in Japan. The three are equally esteemed

and equally high priced, but the Japanese epicure has this advantage over his brothers of other lands—he has no longer any fear of having the supply of the luscious reptiles exhausted.

As I have said, this species is being imported for commercial purposes into this country, and there is every reason to believe that a profitable industry could be developed locally from its culture.

The following information is taken from a recent investigation by the learned Professor K. Mitsukuri, Ph.D., into the cultivation of this creature in Japan.

The present plentiful supply in Japan is owing to the successful efforts of one Hattori, who has spared no pains to bring his turtle farms to a high pitch of perfection, and is able to turn out tens of thousands of these reptiles every year.



Edible "Snapping Turtle" of Japan.

In general appearance a turtle farm is, at first glance, nothing but a number of rectangular ponds (large and small), the large ones having a size of several thousand "tsubos."* The ponds are undergoing constant modification, being united or separated just as need arises, so that their number may vary considerably at different times.

The ponds are so arranged that the water may be drawn off or emptied into them at will. All the ponds, whether large or small, are constructed very much on the same plan. They are bounded on their four sides by plank walls, the top of which may either be on the level of the ground or may be more than a foot above the ground when two ponds are contiguous. In either place the plank wall has a cross plank of some width at right angles to it on its top, and is also buried some inches in the ground. The former arrangement is, of course, to prevent the tortoises from climbing over the wall, and the latter to prevent them from digging holes in the ground and making their escape in that way. On the inner side of the plank wall there is more or less of a level space, and then a downward incline of 3 or 4 feet. At the foot of this incline and directly around the water's edge there is another level space which enables people to walk around the pond. From the edge of the water the bottom of the pond deepens rather rapidly for a space of some 3 feet and there reaches the general level of the bottom, which is about 2 feet below the level of the water. The greatest depth of a pond is about 3 feet, and is always toward the water gate by which the pond communicates with the canals. The bottom is of soft, dark mud, several inches thick, into which the tortoises are able to retire to pass the winter.

On a turtle farm one or more of the ponds is always reserved for large breeding individuals, or "parents," as they are called. The just-hatched young, or the first-year ones, must have ponds of their own, as must also the second year ones; those of the third, fourth, and fifth years may be more or less mixed.

The "parents' pond" does not differ in any remarkable way from the general plan of a pond given above. Usually one of the largest ponds is chosen, and it can be distinguished from the others because one or two of its slopes are usually kept up very carefully, while the other slopes, or those of other ponds, are apt to be worn by rain and wind and to become rugged. These well-kept slopes are invariably on the warmer side, where the sun pours down its midsummer rays longest, and are carefully worked over in the spring so that the tortoises will find it easy to dig holes in them. In the breeding season these sides are seen to be covered with wire baskets which mark the places where the eggs have been laid.

Fertilisation takes place on the surface of the water in the spring. Egg deposition begins a little later, and continues throughout the warm months. Each female lays during that time two to four deposits, the number differing

* One tsubo is equal to an area of 6 feet square. It is the unit in the measurement of small land surfaces.

with individuals and with years. The process of egg deposition is very interesting. A female comes out of the water and wanders about a little while on the banks of the pond in search of a suitable locality in which to deposit eggs. Having finally chosen a spot, with her head directed up the bank she firmly implants her outstretched fore feet on the earth, and during the whole operation never moves these. The process of egg deposition, which takes altogether about twenty minutes, may be divided into three proportions occupying about the same length of time, namely:—(1.) Digging a hole, (2) dropping eggs in it, and (3) closing the hole. The digging of the hole is done entirely with the hind legs; each with its nails outstretched is moved firmly from side to side—that is, the right foot from right to left and the left foot from left to right, and the two are worked in a regular alternation, while the body is swayed a little from side to side, accompanying the motion of the legs. The force put in the lateral pressure of the feet is so strong that the earth that has been dug out is sometimes thrown off to a distance of 10 feet or more, although the largest part of it is heaped up around the hole. Digging seems to be continued as long as there is any earth within the reach of the legs to be brought up. The result is a squarish hole with the angles rounded off, and although its size differs with the size of the female, it is generally about 3 to 4 inches across at the entrance, with the depth and width inside about 4 inches or more. When digging is finished eggs are dropped from the cloaca into the hole, which naturally lies just below it. The eggs are heaped up without any order, but there is no chalazæ, the yolk is able to rotate in any direction, and the blastoderm, having the least specific gravity, always occupies the highest spot of the yolk in whatever position the egg may happen to be dropped. The eggs are generally spherical in shape, although sometimes more or less oblate. The diameter is in the neighbourhood of 20 millimetres, the largest being as large as 24 millimetres, others smaller, according to the size of the female. The number of eggs in one deposit varies from 17 or 18 up to 28 or more, the smaller individuals producing the smaller number.

When the eggs have all been deposited, the turtle's legs are again put in requisition, this time to fill up the hole, which is done by alternate motions as before. The earth about the hole is used at first, but search is made for more loose earth for a little distance, as far around as the legs can reach with a slight motion of the body either to the right or left without moving the front legs. Towards the end of the process the earth is trampled down. When the hole is well filled up to the level of the ground, the turtle turns around and goes immediately down into the water, not casting even one backward glance.

In Hattori's farm a person goes around the "parent's pond" once a day or so, and covers up with wire baskets all the new deposits made since the last visit. Each basket may be marked with the date, if necessary. This covering serves a twofold purpose—the obvious one of marking the place, and, in addition, that of keeping other females from digging in the same spot.

The hatching of the eggs takes, on an average, sixty days. The time may be considerably shortened or lengthened according to whether the summer is hot and the sun pours down its strong rays day after day, or whether there is much rain and the heat not great. It may become less than forty days or more than eighty days. Inasmuch as if small tortoises that have just emerged from the eggs are allowed to get into the "parents pond" they are devoured by their unnatural fathers and mothers, a special arrangement has now to be put up to prevent this. Long planks about 8 inches wide are put up lengthwise around the edge of the pond, leaving perhaps one foot margin between them and the water. Two successive planks are not placed contiguous, but a space of about 3 feet is left between every two, and closed by a bamboo screen put up in the shape of an arc of a circle, with its convexity towards the pond. Thus, the slope or the bank where the eggs have been deposited is completely cut off from the pond itself. In the centre of every pocket-like arched space made by a bamboo screen, an earthenware jar is placed, with its top on the level of the ground, and some water is put in. This elaborate arrangement is for the reception of the young tortoises, which, as soon as they break through the egg-shells—those belonging to the same deposit generally coming out at the same time—crawl up to the surface of the ground by a hole or holes made by themselves, and go straight down the incline toward the pond as naturally as the duckling takes to the water. They are stopped, however, in their downward hydrotaxic course by the planks put up, as stated before, around the pond, and they crawl along the lengths of the planks, and sooner or later drop into the jars placed in the recesses between every two planks. A man going around once or twice a day can easily collect from these jars all the young hatched since the last visit.

The young just hatched are put in a pond or ponds by themselves and given finely chopped flesh of a fish like the pilchard.

During the colder months the Snapping Turtles hibernate, burying themselves in the soft mud at the bottom of the ponds.

When they first hatch out the young average about $1\frac{1}{8}$ inch long and 1 inch broad. At the end of the first year they are $1\frac{7}{8}$ inch long and $1\frac{5}{8}$ inch wide; at the second year $4\frac{1}{4}$ inches by $3\frac{1}{2}$ inches; at the third year 5 inches by $4\frac{1}{4}$ inches; at the end of the fourth year $6\frac{3}{8}$ inches by $5\frac{3}{8}$ inches; at the fifth year about 7 inches by 6 inches. It is probable, however, that the rate of growth would be somewhat faster here, and that the period of hibernation would be shorter. Those of from three to five years old are the most sought after by epicures.

When ponds had been established in New South Wales for any length of time a very considerable amount of natural food in the shape of both plant and animal life would be produced; but, of course, where the ponds were heavily stocked it would be necessary to artificially feed to some extent. In this connection it may be mentioned that the Snapping Turtle is not at all particular as to its diet. It will eat meat or flesh of any kind, dried fish scraps, crushed shellfish, silkworm pupæ, caterpillars (no doubt also plague "hoppers") as well as boiled wheat grains, and other vegetable matter.

In putting forward the suggestion that the cultivation of this aquatic animal should be tried in New South Wales, I am quite aware that there is not nearly so much turtle used as one would think, judging by the frequency of the appearance of turtle soup on some menus. At the same time it seems to me that if a supply were readily available there would very quickly arise a large popular demand for the "real thing," and for the sake of variety alone, hotel and restaurant keepers would be glad to avail themselves of the supply.

Fish that destroy Mosquitoes.

Mr. H. A. Ballou, in a pamphlet published by the Imperial Department of Agriculture of the West Indies, describes a small fish (*Girardinus pœciloides*) which feeds so voraciously upon the eggs, larvæ, and pupæ of mosquitoes that these insects are prevented from increasing in shallow ponds and streams inhabited by it. The fish exist in such numbers that they are locally know as "millions." They commonly occur in Barbadoes, and in consequence the Anopheles mosquito, which disseminates malaria and breeds only in shallow streams, pools, or marshes, has never been able to spread, with the result that Barbadoes is free from malaria. Since 1905, the Imperial Department has transferred these fish to several West India islands, and from all places favourable reports have been received. At Antigua the Board of Health undertook the stocking of all pools and streams with "millions," and the mosquito nuisance has abated in consequence.

It is pointed out, however, that certain varieties of mosquitoes, *e.g.*, *Culex fatigans* and *Stegomyia fasciata*, breed in small temporary collections of water, such as in rain-water tanks, bottles, the concavities of leaves, &c., and that in their case it would be impossible for the fish to be of any service.—From *Nature.*

The Entomologist on visiting Hawaii in 1908 found that three species of "Top Minnows," *Mollienesia latipenne*, *Fundulus grandis* and *Gambusia affinis* were introduced into Honolulu by the Citizens' Mosquito Campaign Committee in 1904. Four hundred specimens were obtained from near Galveston, Texas, and brought over by a trained expert, 500 dollars having been voted for this purpose by the Government of the Territory of Hawaii.

When Mr. Froggatt visited the ponds at Moanalua where these fish had been propagated in 1907, there were thousands of them in all the water-courses round the gardens, and they had been distributed all over the islands of the group.

In the shallow water and swamps which accumulated in the rainy season the authorities cut pits several feet deep into which the top minnows retreated when the waters dried up, and spread out again when the swamps again filled up.

At Barbadoes he also visited the large swamps on the coast with Mr. Ballou, the Imperial Entomologist, where the little fish swarmed in the shallow waters.

Mr. D. G. Stead contributed some interesting notes on "Fishes as Mosquito Destroyers in New South Wales" in the *Agricultural Gazette*, p. 762, September, 1907.

Ensilage.

HUGH ROSS, Inspector.

FROM time to time complaints are rife from the dairy-farmer and stock-owner of the scarcity of green fodder at a season when the natural pastures are bare and cattle are especially in need of some succulent fodder to take the place of the natural herbage. Not only does the dairy-farmer but every owner of stock, may it be sheep, cattle, or horses, pass now and again through the same trying experience, yet the means by which most of our farmers can with little expense lay by a reserve of fodder for times of scarcity are close at hand.

Ensilage is well enough known in most districts, yet the number of farmers who utilise their surplus crop in this manner is comparatively small.

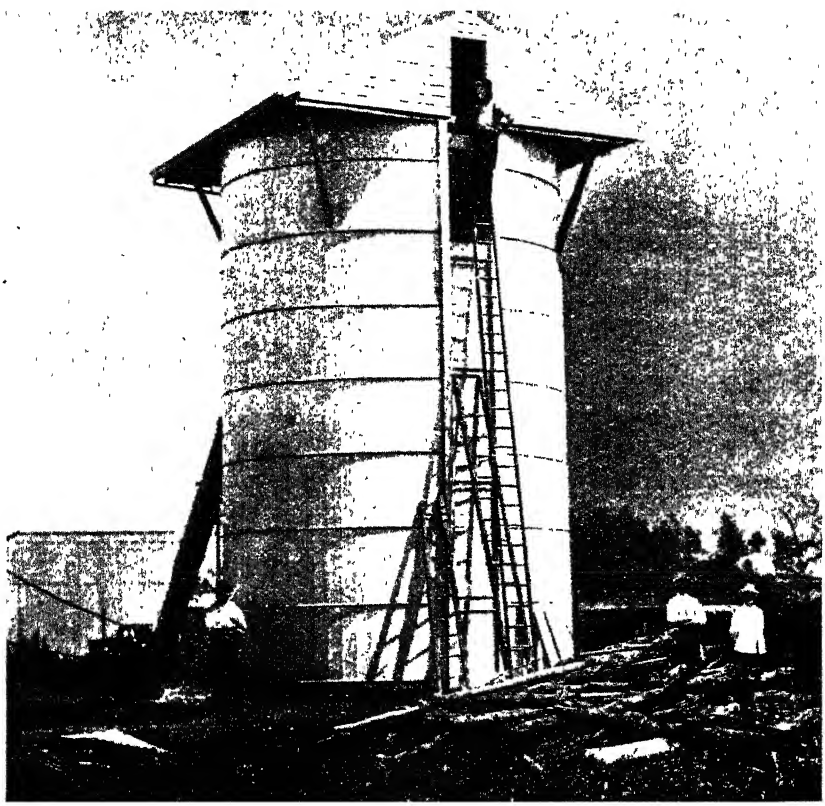
It is difficult to say why this is so; but it appears to me that most farmers consider the expense of erecting silos, excavating pits, or making stack silage outweighs any possible benefits. That such is not the case has been repeatedly demonstrated by those who have either built tub silos or made pit or stack silage, the results obtained having amply justified the initial outlay.

It is, however, especially to the man on smaller holdings that the value of silage ought to appeal, for the larger landowner usually does not feel the pinch of a bad season as much as does the man of limited area and means. Almost any growth of green stuff will make silage; and although it might not be wise to cut the best crop of oats or wheat for silage, a crop dirty with wild oats or other rubbish, if cut for ensilage, will combine the dual advantage of providing a succulent fodder later on, and cleaning the land for next year's sowing. Many dirty crops which would make but inferior hay, or such natural growths as barley grass, crowsfoot, or thistles, useless in their dry state, would, if ensilaged, be always a welcome fodder to any stock. Another point worthy of consideration is that while, say, 100 tons of green oats will make only about 35 tons of hay, 100 tons of green stuff converted into silage will make close on 100 tons of fodder, and can be kept for an indefinite number of years without fear of deterioration or risk of fire.

While it is not intended here to describe the many different styles of silos, their construction, cost of material, &c. (which have been fully described in *Farmers' Bulletin* on Silos and Silage), it may be of interest to know at what cost some farmers conserve their surplus green feed in a succulent condition.

The first Tub Silo in the Jerilderie District.

Mr. S. P. Wilson, Carrah, Jerilderie, on whose farm the Department is conducting experiments with different varieties of wheats, decided some time ago to erect a silo so as to enable him to carry his dairy stock through periods of drought, and to provide a succulent fodder for his lambing ewes. Mr. Wilson has had no experience in building silos, but after consulting Mr. Brooks, who has erected several silos at the Hawkesbury



The First Tub Silo in the Jerilderie District at Carrah.

College, and with the aid of the *Farmers' Bulletin* on Silos and Silage, he was able to instruct a carpenter how to proceed. The result is one of the best built silos in the State. The dimensions of the silo are: 16 feet in diameter and 25 feet in height, roughly speaking, capable of holding 100 tons.

Forty acres, which were very dirty with wild oats, were sown with ½ bushel Algerian oats and ½ bushel of field peas. The crop was cut with reaper and binder the beginning of October, just after the oats had reached the flowering

stage. A No. 11 Ohio chaff-cutter was employed in cutting the green stuff ½ inch long. The filling of the silo commenced and was completed in a few days.

Filling the Silo with chaff-cutter and elevator.

Now a few words regarding the cost of the structure. Grooved Oregon timber was employed for the walls, doors, and elevator, hardwood for the foundation.

	£	s.	d.
The total cost of the timber used, including roof beams, rafters, and sundries amounted to	35	0	0
Iron for hoops, nuts, bolts, staples, &c....	7	0	0
Iron for roof, ridging, and spouting	5	5	0
Linseed oil for painting inside of silo, paint for outside treatment	3	15	0
Link belt, chain, and sprocket wheel for elevator ...	8	15	0
Labour—carpenter	12	0	0
One man to assist	6	0	0
Freight on material	17	0	0
Total	£94	15	0

The crop which was utilised being composed mostly of wild oats, would have proved to be almost valueless if made into hay, but in this state of preservation will, in the first dry year, more than compensate the owner for the original outlay.

A noticeable feature is that Mr. Wilson, with the assistance of the carpenter, who had never seen a silo before, should have been able to

complete the structure so satisfactorily, simply by following the directions given by Mr. Brooks, and noting the specifications in the Departmental publication on "Silos and Silage."

Combined Pit and Stack Ensilage at Deniliquin.

Mr. M. J. Carew, Selbourne Model Farm, Deniliquin, another farmer who is co-operating with the Department in regard to wheat experiments, has come to the conclusion that in order to enable him to increase the carrying capacity of his holding it is imperative to preserve some of his crops in a succulent state. A small stack of oaten silage made by this gentleman last year turned out so successfully and profitably that he decided this year to go in for ensilage on a more extended scale. With this object in view a slightly elevated site was chosen, and the ground excavated by means of ploughs and scoops, 40 feet long, 18 feet wide, and 7 feet deep.

A crop of barley and peas mixed was cut on the green side with reaper and binder, and the filling commenced. The sheaves, with bands cut, were

Cutting crop of barley and peas for ensilage at Deniliquin.

placed into the excavation, care having been taken to tramp them well down. The depth of the pit was increased by using the excavated earth to form a bank all round the pit.

The stack after having finally settled down will be 7 feet below the surface, and from 4 to 5 feet above it; it is built slightly higher in the centre than at the edges, so as to prevent any water from lodging in it. After the sides of the portion of the stack above ground had been dressed, and any loose stuff had been removed, as much as possible of the earth was placed back by

The combined pit and stack at Deniliquin.

means of scoops; the ends were filled up first in a slanting direction so as to allow the horses to walk up with the scoop to the top of the stack.

The cost of excavating was :—	£	s.	d.
Two men, at 7s. per day, for six days	4	4	0
Four horses, at 3s. per day, for six days	3	12	0
Scooping the loose earth back around sides, and on top of stack—			
Two men, at 7s. per day, two days	1	8	0
Four horses, 3s. „ „	1	4	0
Total	£10	8	0

Now, taking into consideration that the men were weekly-paid farm hands, and that the horses belonged to the farm, the actual cost is considerably reduced. The cost for cutting and carting the crop cannot be taken into consideration, in so far as if the crop had been cut for hay, the outlay for cutting, carting, stooking, and stacking would have been as much or indeed more.

In this manner about 100 tons of green stuff has been preserved in a juicy, palatable condition for 2s. per ton; so it cannot be said that the expenditure is in any way a heavy one, while, on the other hand, the benefits accruing from the use of this fodder in a dry season are incalculable.

Another instance of how our natural herbage in a good year may be turned to profit is furnished by Mr. F. W. Hayes, Columbia Park, Corobimilla, who has cut this year with the mower 100 tons of barley grass and crowfoot. He made it into pit silage at a cost somewhat similar to the one instanced above, a cost that is well within the reach of any farmer.

The time has come for farmers to recognise that the making and use of silage has passed the experimental stage; while it is not claimed that the making of silage offers a means to smooth away all the troubles of the farmer and dairyman, it at any rate offers a means to lessen them, and in many instances, allows stock to be turned to profit that otherwise could not be kept on the farm at all.

Maize-smut.

T. HARVEY JOHNSTON, Bureau of Microbiology.

THE various smuts and bunts belong to a family of fungi, known as the *Ustilagineæ*, a group of very great economic importance. Probably the best known of those which injure crops in this State are maize-smut (*Ustilago maydis*); the two barley-smuts (*U. hordei* and *U. nuda*), the loose smuts of oats (*U. avenæ*), and of wheat (*U. tritici*), bunt or stinking smut of wheat (*Tilletia tritici* and *T. lævis*), and flag smut of wheat (*Urocystis occulta*). Another smut (*Ustilago sp.*) is not uncommon on the couch grass in the vicinity of Sydney.

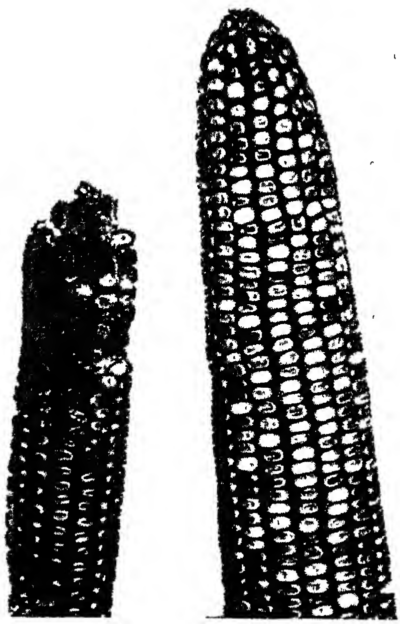
The worst feature of these parasites is that they do not give any indication of their presence until they commence to form their spores. The threads (mycelium) of the smut fungus usually enter the growing point of the young plant, mostly while it is still underground, and grow with its host, ultimately producing the black mass consisting of myriads of tiny rounded spores. These spores in most cases are produced in the grain of the cereal, having been formed at the expense of the starch of the grain, consequently instead of a plump grain rich in starch, there is a mass of spores which may or may not remain covered by the original seed covering. On the rupture of this plant tissue the powdery blackish mass of spores is liberated. These spores germinate under moist conditions, to produce a structure known as a promycelium, capable of giving rise to secondary spores which are able, either directly or indirectly, to infect other plants.

Maize cob destroyed by smut.

Maize-smut differs from most of the other smuts mentioned in that it may attack any part of the plant, viz., roots, stems, leaves, and flowers. It is first recognisable by the production of swellings or galls on the affected part. These are usually whitish, and contain within them a mass of fungus threads which ultimately produce the spores. These so-called "smut boils" become darker in colour and ultimately become blackish. On bursting myriads of

tiny dark brown spores are liberated, each of which is roughly spherical, and if examined under very high magnification, is seen to be covered with very minute spines.

These spores germinate in the following spring when moist conditions predominate, giving rise to the secondary spores which are able to infect any part of the young tissue of the plant. The mycelium, which grows into the host, does not permeate the whole plant, but remains localised, producing a "smut boil" in the affected part. Since the parasite grows rapidly at the expense of its host, the formation and ripening of the grain are seriously retarded, if not actually prevented.



Showing the effects of smut infestation.

It has been proved that the spores germinate readily on fresh cow manure, producing abundant secondary spores which may go on producing other spores, all or any of which may produce infection in new host plants. Hence fresh manure should be avoided. This also emphasises the fact that corn from smutted "heads" should not be fed to horses and cattle, since a large proportion of the spores scattered over the grain passes uninjured through the intestines of the animals and germinates in the manure.

The removal and destruction by fire of affected parts should be carried out if possible, on account of the danger of infecting other plants and even the field itself. Since spores may live for a considerable length of time, but not indefinitely, a rotation of crops is advisable. As it is possible to sow spores on sound seed, it is strongly advocated that all seed should be "pickled" for several hours, say overnight, in about a half per cent. solution of copper sulphate (bluestone). This may be made by dissolving 1 lb. of bluestone in hot water, and then adding enough cold water to make from 20 to 25 gallons of solution.

Grasses and Fodder Plants.

New England Tableland.

[Continued from page 565, Vol. XX.]

R. H. GENNYS, Manager, Glen Innes Experiment Farm.

Lucerne or Alfalfa (*Medicago sativa*)

May well be called the king of fodder plants, for its annual production is enormous compared with other plants, and its quality in food value excellent. It is used in several different ways, such as grazing, soiling (green feeding), for ensilage, or for hay; and instead of being a robber of nitrogen, as many other hay crops are, increases the supply very largely for the use of succeeding crops; its deep, searching roots, too, pulverise and aerate the subsoil for their benefit.

It is an upright, leafy plant, familiar to most people. The taproot, which varies from ½ to ¾ of an inch in thickness near the crown, goes down to a depth of from 10 to 15 feet in average soils, and in very friable suitable subsoils to 30 feet, often reaching water, which, if pure and running, will pull it through the driest seasons, while producing abundant fodder; it will not, however, flourish in stagnant water, nor in oversaturated, cold subsoils.

Lucerne grows to a height of 1½ to 4 feet, yielding from 2 to 9 tons of hay per annum. In New England, however, not more than three good cuttings can be expected. The plants should last from six to ten years when cut—not grazed—and in very favourable situations up to twenty years or more.

Preparation of the Soil.—Ploughing must be very deep in the first instance, and if the subsoiler can be used so much the better. A good liming at the rate of about 1 ton of unslaked lime to the acre, spread on after air-slaking in heaps in paddock, then incorporated evenly with the top-soil by harrowing roughly. A few weeks later bring surface to a fine state of tilth by a shallow second ploughing or discing for the reception of the seed. The surface must be friable and free of weed-germs, as the young plant is at first small and delicate. If the land is quite clean, spring sowing is good, but it should be fairly early that the plants may be well into subsoil before hot weather. There is less risk in autumn planting, but here again see that plants are well rooted before severe frosts set in. An important point is that the seed be only very lightly covered. Here, it has been shown that good germination may be obtained on a fairly cultivated surface. Where nothing but heavy clods are obtainable and the season will not permit of waiting, sow the seed without further interference with the soil.

Seeding experiments on this farm show that on well prepared land about 8 lb., with drill, of first-class seed to the acre is sufficient. The plants should then be thick enough to cover the ground without being crowded. When broad-

casted, sow 14 lb. to the acre, and it is better to sow such small seeds half one way, then cross the cast with the remainder; patches missed at first will then be more likely to receive some seed. An experiment was made here with only 4 lb. of seed to the acre with drill. The plants when fully grown did not cover all the ground, but they were very vigorous, and the late Mr. Farrer thought that such strong, deep-rooted plants would produce the best seed, and I think this is obvious. Experiments with very thick seeding showed that the amount of fodder produced was not nearly so great as moderate seeding; the plants were crowded and delicate, and when a dry spell came they were the first to wilt. Lucerne is generally fit to cut when a small proportion of the crop has flowered; but in New England it is found that sometimes the young shoots from the crown begin to grow before flowers are seen, showing that the crop has reached its maximum of nutriment. And again if the young shoots are cut it is a setback to the succeeding crop.

Lucerne hay must be made quickly. The best practice for this district is to first rake into windrows; turn over only once, not shaking much or the leaves, the most valuable portion, may fall off; put into small cocks for a short time before stacking, so that it may not heat. Perfect hay should be leafy, with pliable stalks, and quite green when cut out. Sometimes lucerne which has not been dried perfectly in the field will turn brown in the stack, and, generally speaking, such hay is quite palatable and nutritious, although not as saleable as green hay. Lucerne seed should be bright and yellow; too dark is not a good sign.

Lucerne should not be grazed or mown too closely for fear of injury to the crowns, although harrowing or discing after the crop is taken off appears to have a good effect. In New England, lucerne in many cases does not flourish so well on the low black flats, the subsoil being too stiff and cold, but on the well-drained slopes better results have been obtained, the Algerian variety appearing to adapt itself better to these conditions; but, of course, the growth is limited compared with that on river flats in warmer districts.

Cattle and sheep must be turned into young succulent growths with caution at first or bloating may follow. Avoid putting them on with empty stomachs, and not for too long at a time, for a few days. They should not be turned in during wet or windy weather.

Lucerne is excellent for all growing animals on account of its large protein contents, which is converted into blood, muscle, and bone, but for working horses should be fed with some grain. The same may be said when fattening pigs. Lucerne hay is valuable for milking cows.

Diseases.—Root-rot (*Ozonium auricomum*), which attacks other plants also.

Leaf Spot (*Pseudopeziza medicaginis*) is very destructive to a crop, though it does not generally hurt the roots. Brown spots appear and gradually spread over the leaves, causing plants to die to level with the ground; frequent cutting at early stages is good.

Dodders (*Cuscuta epithymum* and *trifolii*) are its parasitic enemies. These plants do not draw their nourishment from the soil but from the host itself, sucking the juices. They are long, yellow, thread-like substances entwining and growing up with the main plant.

Mow infested spots frequently to prevent the parasite seeding, and burn everything connected with it.

Do not sow infested seed. The dodder seed is very small, and with proper sieves of very small mesh may be got rid of, but there is always the risk that some may be left.

It is pointed out that, although lucerne does not require nitrogenous manures, it must have a good supply of phosphates and potash for its successful growth.

Common Red Clover (*Trifolium pratense*)

Is a leguminous fodder plant, the great value of which is little recognised in Australia. The plant generally is only a biennial, but may be carried on for a number of years in a pasture by allowing the crop to form seed every second autumn and harrowing when heads are well matured and withered-looking, so as to shake out and well distribute the small seeds, which will root without soil covering. The bumble or humble bee, no doubt, is of great use in promoting a heavy marketable crop; but other insects are effective agents to produce seed for carrying on a pasture, as has been proved here beyond doubt on an experiment of several acres; the old plants have died out, and after about four years the young growths are thicker than they were just after the original sowing. It has been noted that one at least of our indigenous bees (*Saropoda bombiformis*) frequents clover paddocks. As an adjunct to a shallow pasture grass to balance the ration for stock, for filling up the spaces between plants, and for assisting their growth by opening up the soil by their deep roots and supplying nitrogen to the soil adjacent, red clover is invaluable, and of itself, both for grazing, green feeding, for hay, and for silage, is almost equal to lucerne. See Analysis of Fodder Values of each below, from a standard work in America, where both are largely used. It is said all crops do well after red clover, and for wheat production on medium soils it is a grand nitrogenous fertiliser, besides providing organic matter and opening up the subsoil with its roots It has been found here that the best and cheapest method of securing a good stand of clover is to grow it with wheat as its nurse-crop, sowing it about six weeks or so after wheat is above ground. Harrow the wheat crop first, then broadcast about 10 lb. clover seed to the acre. The wheat is nearly always harrowed here for its own benefit, so that is not an extra expense, the price of the seed and its broadcasting being the only extras necessary for the clover. The wheat acts as a splendid nurse to the young plants, which in no way interfere with a good crop, as is shown by these results. A portion cut off for hay yielded 3 tons 9 cwt. to the acre, and the remainder, cut for grain, of three varieties, panned out thus: Comeback, 32 bushels to the acre; Haynes' Blue Stem,

31 bushels; and Thew, 26 bushels of splendid grain. There were about 6 acres in all treated this way. The clover made very little growth while the wheat crop was standing; but two months after, a splendid pasture was available, and sheep were topped, some of which were slaughtered for the Sydney Sheep Show and pronounced too fat for export. First cross wethers dressed to 98 lb. (without inside fat), and second crosses, 20 months old, to 77 lb., and others were proportionately good. Again, in the spring following, a still better crop was available.

The seed bought for pastures here was supposed to be perennial red clover (*Trifolium pratense perenne*), or cow grass; but it has failed, so far, to establish its perennial nature, and, as before stated, the majority of plants are only biennial, and the pasture must be continued by self-seeding. An attempt is being made to try and find out if we have two distinct varieties or only one in this State.

It is stated that in England, after a time, soil becomes clover-sick. Possibly, however, a good supply of phosphates and a little potash will remedy this, for, as was pointed out in the early portion of these articles, phosphates must sooner or later become exhausted, as they are taken up by young stock for bone-making, and very little returned again by them.

In heavy clay lands in temperate districts, where rape does not flourish too well, red clover comes in well, and adds nitrogen to the soil, which rape does not.

Black Medic (*Medicago lupulina*).

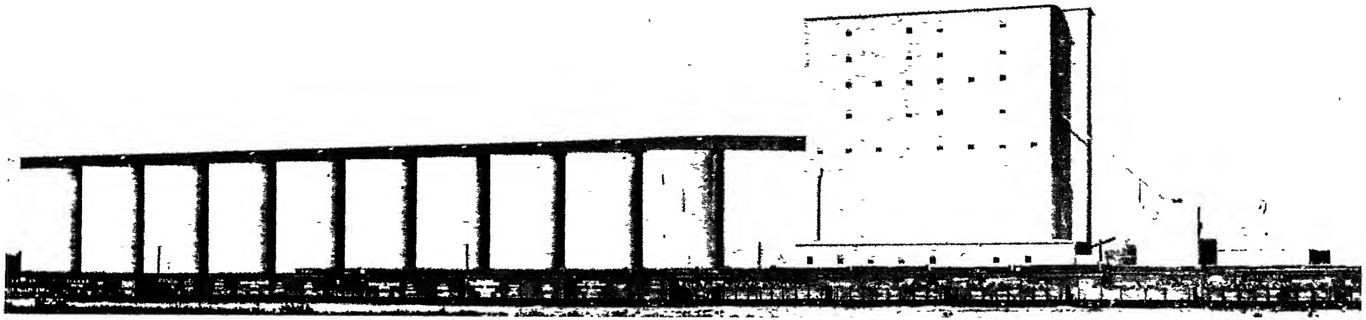
A trefoil that has done well here is described by Mr. J. H. Maiden, Botanist, as a common British weed of the order of Leguminosæ, growing on dry banks and hilly pastures, and chiefly on sandy and dry soils. It appears to suit our clay lands well, too, and is much relished by stock. The seed vessels are in clusters, small, black (when ripe), and not injurious to wool. This is not one of those known as burrless medicks, which have not had much trial here as yet, but their growth should be encouraged wherever they will do well, as their seed-pods do not injure wool.

Burnet (*Poterium sanguisorba*).

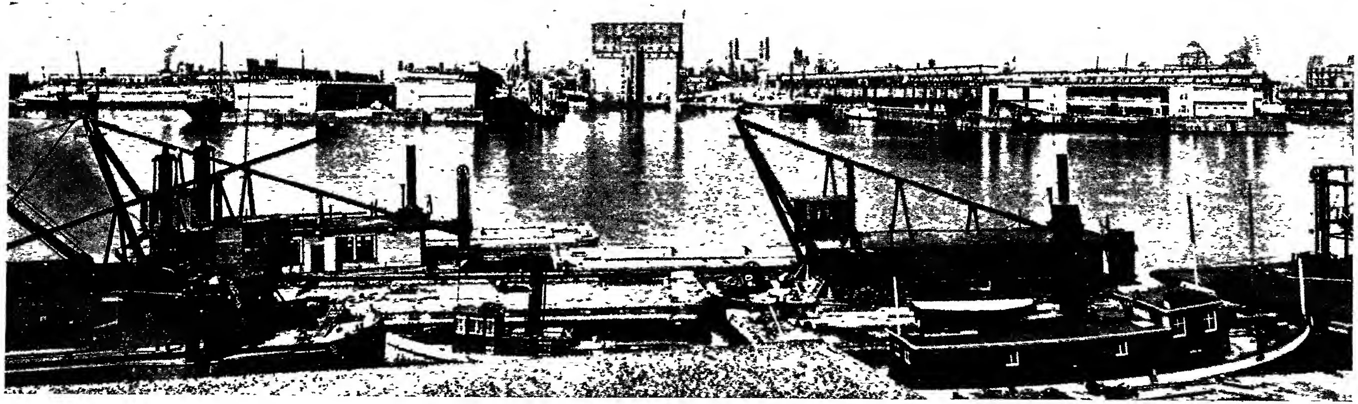
A plant somewhat resembling sainfoin, though neither seed nor flower quite like it, as the former, being only a hard greenish head, is not in any way like the flower of sainfoin. The plant is deep-rooting, stands both frost and dry weather well, and much liked by sheep. It has done well here in small trials, and will likely be useful in filling up spaces between such a grass as Cocksfoot.

ANALYSIS of Black Medick and Burnet, by Mr. F. B. Guthrie.

	Moisture.	Ash.	Fibre.	Albuminoids.	Carbohydrates.	Fat, or Oil.
Black Medick	72·76	2·77	4·29	7·00	12·48	0·70
Burnet	56·16	3·85	9·87	4·88	23·04	2·20



Inland Elevators.
Frame working house, capacity 260,000 bushels; reinforced concrete storage bins, capacity 720,000 bushels.



Terminal Elevators—Bulk Handling of Wheat in America.
Conveyor system for Harbour Commissioners of Montreal, for taking grain from elevator and delivering to ocean steamers. Entirely fireproof. About 1¼ miles of gallery will be in the installation when complete. These conveyors will serve fourteen vessel berths.

PERCENTAGE Feeding Values from American Encyclopædia of Agriculture.

	Water.	Ash.	Protein.	Fibre	Nitrogen Free Extract.	Fat.
Alfalfa, or Lucerne (green) ...	71·8	2·7	4·8	7·4	12·3	1 0
Alfalfa, or Lucerne (hay) ...	8·4	7·4	14·3	25·0	42·7	2·2
Red Clover (green)	70·8	2·1	4·4	8·1	13·5	1·1
Red Clover (hay)	20·8	6·6	12·4	21·9	33·8	4·5

As Red Clover may flourish in situations and soils where lucerne will not do well, it will be seen by the above what an excellent substitute it will make. Its silage value is also great.

THE WORLD'S WHEAT SUPPLY.

IN response to requests for information as to the world's wheat supply the following return is published. The year 1908 is the latest date for which definite returns are available.

	1898.	1904.	1905.	1906.	1907.	1908.
	bushels.	bushels.	bushels.	bushels.	bushels.	bushels.
Europe . .	1,521,600,000	1,747,262,000	1,797,345,000	1,810,448,000	1,618,476,000	1,751,696,000
North America.	764,000,000	636,006,000	815,130,000	875,066,000	739,094,000	787,136,000
Asia . .	320,000,000	477,550,000	432,152,000	451,250,000	466,710,000	306,992,000
South America..	120,000,000	154,620,000	170,399,000	151,694,000	178,636,000	216,919,000
Africa . ..	40,400,000	63,496,000	58,795,000	66,536,000	64,937,000	58,341,000
Australia and New Zealand	54,485,000	63,659,255	75,319,706	71,705,906	50,222,812	71,220,685
Total .	2,820,485,000	3,142,593,255	3,349,140,706	3,426,699,906	3,118,075,812	3,192,304,685

In order that the relative contributions of the respective States of the Commonwealth and of the Dominion of New Zealand may be readily seen, the following figures, furnished by the Government Statistician, are reproduced.

State.	1904–5.	1905–6.	1906–7.	1907–8.	1908–9.
	bushels.	bushels.	bushels.	bushels.	bushels.
New South Wales. .	16,464,415	20,737,200	21,817,938	9,155,884	15,483,406
Victoria	21,092,139	23,417,670	22,618,043	12,100,780	23,345,649
Queensland... ...	2,149,663	1,137,321	1,108,902	693,527	1,202,799
South Australia ...	12,023,172	20,143,798	17,145,796	19,135,557	19,397,672
Western Australia..	2,013,237	2,308,305	2,758,567	2,925,690	2,457,483
Tasmania	792,956	776,478	651,408	644,235	560,886
Commonwealth ...	54,535,582	68,520,772	66,100,654	44,655,673	62,447,895
New Zealand ...	9,123,673	6,798,934	5,605,252	5,567,139	8,772,790

Packing Apples for Export

J. G. R. BRYANT.

PRACTICALLY half the profits in fruit-growing depend upon the condition in which the products reach the consumer. An observation of the markets in our city and towns will show that there is great room for improvement in the preparation of fruit for market. On every side can be seen farm produce selling at reduced prices, or else cast aside by the agents as not worth handling, owing to the damaged or unattractive condition in which it has arrived. The average buyer is attracted by the appearance as well as by the quality of the goods. The grower who would dispose of his commodities profitably must study the demands of his market and cater for the fancies of the trade. There are two markets on which the grower can dispose of his produce—the local or home market, and the distant or foreign market. Those who can sell on the former have advantages over those selling on the latter. The local market affords the grower an opportunity of coming face to face with the consumers and learning their preferences. He is enabled to put his produce on this market in a more attractive condition than he can when shipping some distance. Another advantage is the chance the grower has of using his packages an indefinite number of times, and the commission and other charges are very much lower. These charges occasionally absorb a large percentage of the revenue derived from the sale of produce sent to distant markets, thus leaving the grower very little for his labour, worry, and packages. However, this should seldom happen unless brought about by careless and indifferent preparation. Every fruit-grower is not so fortunately located as to have the advantages of a good local market for his produce, which must therefore go to some distant market, there to compete with the products from other sections, and foreign countries. This competition is gradually increasing, and only the better grades of produce pay for cases, transportation, and commission, and leave a margin of profit for the grower. The more care given a crop at the farm end results in greater profits at the market end. Cleanliness, neatness, and uniformity are three qualities required in the preparation of fruit for market to secure and hold a select trade that will be profitable.

Varieties.

In selecting for export, growers cannot do better than confine themselves to not more than five or six standard varieties. It is much better to send those which are known to the trade and consumer.

The three varieties mostly sent from this State, and from which best results have been obtained, are—Jonathan, Cleopatra (or New York Pippin), and London Pippin (or Five Crown).

There are, of course, others shipped which give profitable returns, and of these the following are the best:—Rome Beauty, Munroe's Favourite, Granny

Smith, Stone Pippin. In the Bathurst orchard, we have found that for early shipment to England, Cleopatra and Jonathan are suitable, and for later shipment to America, Rome Beauty and Granny Smith.

With reference to pears, the varieties mostly exported are Vicar of Winkfield, L'Inconnue, Winter Nelis, Josephine de Malines, Broom Park, Eyewood, Keiffer's Hybrid, and Winter Cole.

Picking.

In picking apples for export, actual experience is the chief means by which the grower will be enabled to pick his fruit at the right time. The fruit is in a fit state to pick as soon as the seeds are well coloured. If picked before, the chances are that it will shrivel if kept for any length of time. The fruit should be fully developed, but not fully ripe, and a fair amount of colour should be showing in the red apples. Fruit should not be picked unless dry. Always endeavour to keep it as cool as possible. Stand picking cases in shade of tree, and haul to shed as quickly as possible. Avoid all bruising, as bruised fruit is useless for export; do not shake or drag the fruit from trees; the manner in which it is grasped is very important. The picker should not grasp the fruit and press down the ends of the fingers, because by so doing fruit can be easily bruised; he should surround the fruit with his hand and fingers, allowing it to rest gently in the hollow of the hand, the fingers touching lightly all round; then raise the fruit up slightly, which makes it separate more easily from the tree, and at the same time give a gentle pull. Break each fruit off at the spur, retaining the stem, which, if torn out, leaves an opening for germs of decay. It is a good plan to go over the trees several times, never taking fruit less than 2¼ inches in diameter. Before packing, the fruit should be cooled off and sweated; this will give it a chance to get down to the proper temperature, throw off any moisture, toughen the skin, and adds to its chance of successful carriage. If fruit is intended to be held by the grower in his own store-room, it would be better to pick it when cool, and store it away in cases well lined with paper, opening the room by night and closing it in the daytime, so as to keep the temperature as low as possible, otherwise the fruit will become soft and useless. In some of our cooler districts I have seen it keep as well in cases underneath the trees as in enclosures. If apples are stored any length of time they should be packed in close packages, which are better if lined with paper. Apples which are to be kept in cold storage must be picked without bruising, and if the weather is warm, should be stored as soon as possible after picking.

The fruit-grower works a year to produce a crop of fruit, and by rough handling during picking, packing, &c., it is often so damaged that its value is reduced by 50 per cent. Every apple when picked should be placed in the receptacle, not dropped in. It must be remembered when picking that the fruit spurs are wanted for next year's crop as well as this, therefore do not knock them off. A great amount of loss occurs from picking fruit too green, or lacking in colour; also from picking too ripe, fruit which is intended for

export. It would be impossible to give exact rules for determining the best time to harvest apples for export; this can best be learned by personal experience, guided by the ripening habits of the different varieties grown. These habits vary in different districts. Pickers should have strong light ladders for getting about among the branches.

Grading.

The grading and sorting of most fruit is done when the fruit is being packed, but the grading of apples should be done before the packers begin their work. Grading apples depends on the variety of apple, the market in which it is to be sold, and the price. First grade must certainly be well sorted; by that I mean that no first grade box of apples should contain wormy, bruised, scabby, smutty, cr any other defective fruit which would mar the appearance or affect the quality. In the second grade, minor defects are allowed, but the grading of this also must be uniform. The term grading is generally misunderstood, as grading refers to selection for quality as well as size. There have been many contrivances invented for grading fruit, but most of them have proved unsatisfactory. The apple orchardists in Tasmania use a machine grader of which they speak very highly. Grading may be started in the orchard with the growing crop, as careful cultivation means fewer culls and greater uniformity in size.

The chief points in grading are:—Size, colour, freedom from disease, uniformity through every case.

The export market generally demands a good, clean, medium-sized fruit, 2½ inches being about the ideal, as the buyer generally wants what to the trade is known as a good count. Extra large fruit is not desirable, as these are generally coarse, and do not keep so well. As a general rule three sizes are shipped (2½, 2¾, and 3 inches); with varieties such as Jonathan, that have good colour and do not run large, 2¼ will pay to ship. When grading, any fruit which shows the slightest sign of disease should certainly be thrown out.

It is impossible to overestimate the importance of grading apples for market. It is a thing which cannot be overdone. Most fruit is practically unsaleable without grading, and the better the grading the better it sells.

At our Bathurst Government orchard when packing apples the following grades are adopted:—

Extra Choice, 3 inches.

Extra fine specimens only, uniform in size, colour, and form, and without blemish.

Choice, 1st—2¾ inches.

Good fruit, not so fine as Extra Choice, uniform in size, colour, and form, and practically free from insect, injury, and defect.

Specially selected, 2nd—2½ inches.

Mostly good eatable fruit, uniform, and not conspicuously marked by insect, fungus, or other damage.

Selected, 3rd—2¼ inches.

Best small grade, uniform, sound, and free from conspicuous injury.

Packing Houses.

One of the principal features in handling large crops of apples to the best advantage is a proper packing-house. This should be roomy; of course, a lot depends on whether a large amount of the crop is to be stored in the house at one time. With stone fruits, grapes, &c., these are generally picked, packed, and despatched the same day. The apple crop is different; generally speaking, when apples are ready the rainy season is at hand, and there must be sufficient room to contain a large quantity of apples in the packing-house. Some days you can pick and some you cannot, on account of the weather. Some varieties may have to be kept stored until the market price rises.

The packing-room should be well ventilated, and above all have plenty of windows, so as to give a good and sufficient light (see illustration); arrangements also should be made to light the room. In storing apples in the packing house from the orchards, cases may be piled one on the top of the other, but must not be filled so full that the cases will press on the fruit underneath.

Packing.

One of the principal features of an orchardist's work is to so grade and pack his fruit that when it is offered for sale it presents an attractive appearance, because of uniformity and minimum amount of injury from transportation. This one item determines largely the success or failure of the grower to realise the best market price for his product.

The following points in reference to packing are worthy of especial note on the part of the grower.

The Packing Shed at Bathurst Orchard, showing students packing apples for export.

Every grower's pack should be as good as his bond; no topping up, nor filling up corners with small apples; buyers want honestly packed goods, and they are usually willing to pay good prices for such. Each case should be filled with the same grade throughout; a few seconds or culls scattered in with a lot of prime fruit gives the buyer an opportunity to discriminate against the whole package, and ruins the reputation of the grower.

Apples must be cool and dry before being packed. Heat and moisture promote decay. Each case should be well filled, with the contents placed firmly and snugly. Every day consignments are placed on the market, showing evidence of careless packing. If growers would consider for one moment the average route travelled by a case of apples for market they might be a little more particular. The case is taken from the packing-shed and put on the cart; it is then hauled, perhaps, for some miles over the average country road to the railway station. After bumping along in the train for some miles, it is again unloaded and placed in a lorry and hauled for several squares over the city streets to the boat, where it is unloaded again ready for shipment to its destination, when, after some more knocking about, it is opened for the inspection of the foreign buyer, and to compete against the fruit of the world. Unless the case has been well filled and packed before starting, it will reach the market in what is commonly known as "slack" condition. The numerous jarrings received *en route* will have caused the contents to settle and shrink, with the result that the case will only be partially full.

Buyers will not pay the price of full packages for those received only filled in part. The sale is not only affected in this way, but loose packing invariably causes bruises and the general defacement of each specimen. Too tight packing must also be guarded against, as this generally results in bruising. There is a happy medium in packing that can only be learned by practical experience.

Wrapping.

Whether the apples should be wrapped or not depends somewhat on the variety and the grade of fruit. Wrapping has several advantages:—

1. It serves as a cushion in the case of delicate fruit.
2. It prevents rot and fungoid diseases from spreading from one fruit to another.
3. It maintains a more even temperature in the fruit.
4. It has a somewhat more finished appearance when exposed for sale.
5. Wrappers keep the fruit firm and snug in the packages.

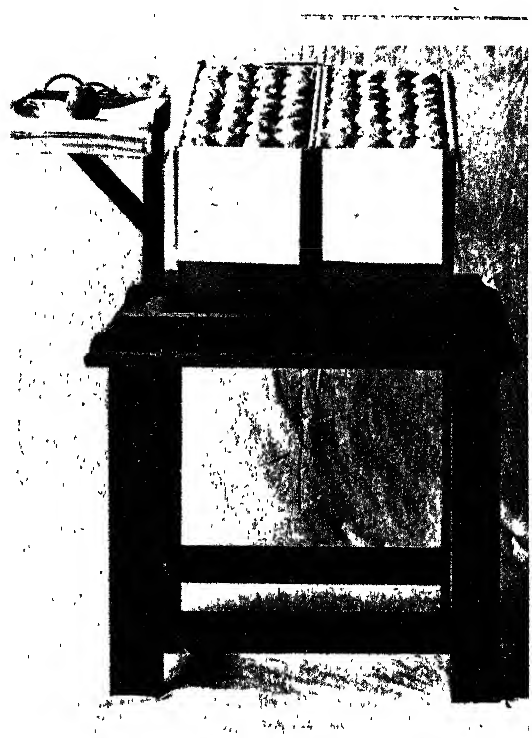
Disadvantages of wrapping:—

1. It adds to the cost of packing.
2. It prevents rapid cooling in cases where the fruit is not cool at the time of packing.

Proper wrappers can be purchased by the thousand for the various-sized fruits, and a 2-inch fruit should not be wrapped in a paper large enough to accommodate a 3-inch fruit, nor should a 3-inch fruit have a wrapper put on

it which has been cut to fit a $2\frac{1}{2}$-inch specimen. Generally speaking, paper 8 inches by 10 inches will pack most grades. It is customary in large sheds to have the name of the packer nicely printed on the wrapper.

When packing for export proper tables are necessary (see illustration). The fruit is generally turned out on tables running along the inside wall of shed. To pack rapidly and thoroughly the packer must have fruit before him which runs evenly in point of size. He should endeavour to grade to colour, keeping the best coloured specimens in the one case. Skill in packing can only be gained by practice. It requires a smart hand and a trained eye, so that slight differences may be recognised, and boxes so firmly packed that they may be put on end with the lid off and yet no apples fall out. The following diagrams will show the method of commencing the principal styles of packs used for export.



Apple Packing Stand, as used at Bathurst.

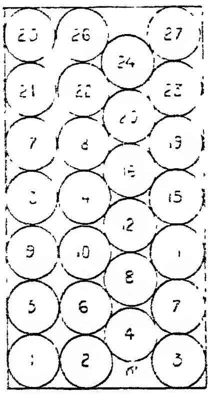
The table is constructed of pine, like a kitchen table, so that it will stand perfectly firm and bear a fair weight. Strong ledges or battens are affixed firmly to front and back of the top of the table, so that the fruit case may be tilted on the back one and prevented from slipping by the front ledge, as shown. At the left-hand side of the table a stand is affixed, with a ledged tray to carry the wrapping-paper, stencils, &c.

In making the table, the height should be such as to enable the packer to get his hands comfortably into the bottom of the case.

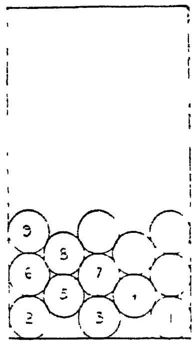
When the packing is completed, wood-wool is generally placed on top of the fruit prior to the lid being nailed in position, four nails being generally used for export boxes. Cement-coated nails have proved very good for this work.

There are many kinds of packs, but for general purposes the straight pack, the diagonal or wedge, and the three-two-three or filling the spaces diagonally are those mostly used, all of which have given good results in shipping to the Home markets.

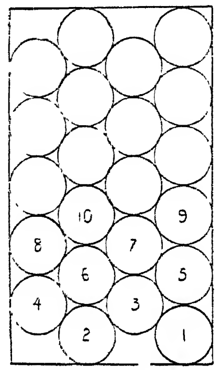
With the straight pack all apples are placed stem down one on top of the other. The diagonal allows no apple directly over any other which it touches. The apples usually in the alternate layers are directly over each other but never in the contiguous layers. The two-three-two for large fruit is made by



Diagonal or Wedge.



3-2-3 Pack.



2-2 Straight Pack.

placing three apples in the first row, one in each corner and one in the middle; the second is made with two apples; the third with three, and so on till the layer is completed. The second layer is commenced with two apples and alternated with three, as in the first layer.

In packing pears for export expert workmanship is required, as it is a very difficult problem. Pears require a much tighter pack than apples The diagonal pack is generally used. The pears at the end of the box are generally placed with the blossom end pointing to the end of box.

Cases.

The size of cases for export is regulated by the Commerce Act. Under this Act shippers must see that their cases comply with the regulations. The timber should be well seasoned, free from colour, odour, and moisture.

Cases for apples should not be air-tight, but should be so made as to allow the free circulation of air through the interstices and permit the escape of any moisture. Using damp cases is particularly to be avoided, *i.e.*, green timber.

Branding.

Under the regulations of the Commerce Act the following information must be branded on case:—The name of the fruit contained in the case, *i.e.*, sound apples or pears; the quantity; the name of the grower or exporter; the name of the State where grown; and the word "Australia." It is found advantageous to add the variety and grade for the benefit of the agents.

For branding, use neatly-cut stencils; brands painted or labels pasted on the case are not to be recommended.

When loading at the railway always endeavour to obtain a louvre-van for the carriage of fruit. The open truck is not desirable.

Be very careful in stacking fruit in the truck. Avoid having it too high; stack the cases so that they present a level face all over the bottom of the truck.

Generally speaking, the fruit-carrying steamers leave about the middle of February, and the work is continued by mailboats every week up to the end of April. After this date it is not advisable to ship, as the English soft fruits are coming on the market.

Roughly speaking, the cost per case to land apples on the London markets is :—

Cases	1s. 0d.	per case.
Wrappers	1d.	„
Grading, packing, nailing	2d.	„
Rail freight	3d.	„
Ocean freight	2s. 9d.	„
Insurance and commission	7d.	„
Supervision	2d.	„

Total, per case, 5s.

Soy Beans.

Recently there have been numerous references in the agricultural press to the Soy bean or Soja bean as food for cattle and also for culinary purposes. The Commercial Commissioner in the East, Mr. F. D. Suttor, has furnished a very comprehensive report on the use of this bean and other varieties of the *Phaseolus* group in Japan.

It is to be feared, however, that so far as New South Wales is concerned, the cultivation of Soy beans is not likely to attract much attention. Experiments have been carried out at the various Experiment Farms for nearly twenty years, and trials on a large scale seem to indicate that however satisfactory these beans might prove in certain suitable districts, they are not likely to prove as profitable a crop for market as other pulses, such, for instance, as Cowpeas, for which there is generally a pretty good demand at prices ranging to 10s. per bushel.

Mr. Suttor forwarded samples of seed, which have been distributed for trial.

According to the *North British Agriculturalist* some 50,000 tons of these beans were imported to Scotland from Manchuria last year for the manufacture of oil and cattle cake.

Smut in Wheat.

Although smut in wheat (*Ustilago carbo*) is a disease not always in evidence in our wheat crops, there are seasons when it affects crops to a serious extent. The wheat-growers of Australia are indebted to Mr. Frank Maddox, of the Eastfield Cereal Experiment Plots, Tasmania, for a valuable and highly important contribution to our knowledge of this disease, and especially the manner in which it infests a growing crop of wheat.

Mr. Maddox's work in wheat experimentation goes back as far as 1892, when he initiated series of experiments to ascertain the relative value of a number of varieties of wheat commonly grown in Tasmania.

Mr. Maddox has spared no pains to conduct his experiments and work out his deductions with scrupulous accuracy. But it is in the matter of disease investigation that results of the greatest interest to our farmers have been arrived at.

In connection with smut, Mr. Maddox, after reviewing the opinions expressed in standard works on diseases of crops, says:—

The statement as regards pickling destroying spores upon the seed is, no doubt, quite correct. I will now give the conclusions I have arrived at with smut from the results of my experiments. I have never been able to cause infection and reproduce the disease with spores in the grain or in the ground, which I can so easily do with bunt spores to reproduce bunt. The only way I have been able to infect grain and reproduce smut (which seldom fails) is by putting the spores on the ovary of the plant at flowering time, about the same time as the pollen grains are being shed. The grain will mature without the slightest signs of being diseased. I have hit the time so well now that I may say I never have a failure. I think this accounts for when I did fail, viz., the ovary was not forward enough, or too far forward, for the spore to get its seed-bed; or possibly sometimes the spores were not matured enough. The comparison of bunt and smut spores finding their seed-bed is the very opposite. It is really wonderful to me how smut spores do, as the ovary is well protected by the glumes or chaff, and there is only a short period that infection seems to be able to take place; but a close observer will notice how Nature takes her part. We all know that smut ears appear at the same time as the sound ones, and I think that when the ovary is ready, so are the spores; but there can be no doubt that when one spore finds a seed-bed, many millions do not. In one of my first experiments I found a plant of four stools, one with sound and three with diseased ears. I sowed the grains from this sound ear, pickling half of them. About forty plants matured, and the result was that eight were diseased, five being among the pickled and three in the unpickled. The following year I tried the same experiment; but this time I found a plant with five stools, four being diseased and one not. It was a very fine ear, from which fifty plants matured, with the result that there were only two diseased plants, one being again among the pickled seed. From this experiment I have now come to the conclusion that it accounts for more smut in a crop one year than another, as in the first year, with only three diseased ears close to the sound

one, eight spores managed to find their seed-bed, while in the second year, with four diseased ears close to the sound one, only two spores managed to do so, showing that with a smaller percentage of diseased ears in the first year's crop to the second, the seed from the first year's crop gave a very large percentage of disease and with a larger percentage of disease in the second year's crop than the first; the seed from the second year's crop gave a smaller percentage of disease—the opposite to what one would expect; so there is no rule of thumb about it, but all chance work for the spore to reach its seed-bed. In one year there may be more insects about than another that would carry the spore to the ovary, as I have no doubt they do. On a very small insect (that I always find in more or less numbers in an ear of wheat) which I submitted to the Rev. E. H. Thompson, late Government Entomologist, to examine under the microscope, he discovered smut spores. So Nature evidently somehow favoured the first more than the second year's spores. This experiment also showed me at the start that the ordinary pickle that prevented bunt was useless for smut. After making the discovery that the spore required to get on the ovary to reproduce the disease, I started pickling these artificially-infected grains in many ways; but all the picklings that will cure bunt have failed to cure smut; and to many well-known farmers in Tasmania who believed they could pickle to prevent smut, I have forwarded artificially-infected grains; but the results were always diseased plants. The partially diseased I account for as in bunt; but these partially diseased smut plants put the idea into my head to see if it was possible to give the same plant the two diseases, and by putting bunt spores on artificially-smutted wheat the result was that the smut predominated; but any ear that was free from that disease would be bunted, proving that these two spores can live in one host plant, and showing what totally different spores they are.

To further prove my conclusions, I have destroyed all infected ears directly they appeared on a plot of 4 rods for two years in succession. The seed from a 4-rod plot gave me sufficient to sow half an acre each year, and it was indeed a difficult job to find a diseased ear, although the same kind of wheat in the adjoining land had the smut ears showing through it to the extent of 1 to 2 per cent. of the crop, the pickling before sowing being done in the same tub in each year's experiment.

It is interesting to note that nearly fifteen years after Mr. Maddox conducted these experiments his conclusions are confirmed by the researches of such eminent European mycologists as Messrs. Hecke and Brefeld, who have been engaged for some time in this important work. The authorities of the United States Department of Agriculture, under whose notice the work of Mr. Maddox was brought by the Tasmanian Department of Agriculture, state that "during the last two years numerous inoculation experiments have been performed with the loose smuts of wheat and barley. In the case of both of these smuts, infection takes place only at the time of flowering. The conclusions of Mr. Maddox in regard to time of infection of loose smuts of wheat, and the non-success of pickling as a prevention of loose smuts, are correct."

Making Provision for Green Winter Fodder.

R. W. PEACOCK, Manager, Bathurst Experiment Farm.

THE necessity of making provision for the winter months for dairy cattle and ewes and lambs needs no comment.

A discussion of suitable crops, and the manner in which they fit into a system of mixed farming, should prove helpful to many of limited experience.

The following notes are written with special reference to the requirements of the wheat and sheep farmer.

The principal desiderata of any crop are that it should grow during the cold weather, be palatab'e and valuable as a fodder, will withstand a considerable amount of tramping, will fit in well in rotation, and allow of seasonable operations in preparing the soil for succeeding crops, will not exhaust the soil, and if rationally treated, will provide a considerable amount of residue to improve it.

Cape Barley and Rape in alternate rows at Bathurst Experiment Farm.

The practice which has been found at this farm to comply with these conditions best is to sow Dwarf Essex rape and Cape barley in alternate drills by means of the ordinary wheat drill. One cwt. of superphosphate is applied with the seed. From 3 to 4 lb. of rape is used with 20 lb. of barley per acre. The rape is sown from grass seed attachment, the barley from wheat box, and the manure distributed with both. The application of superphosphate

gives a most vigorous start, and practically doubles the amount of fodder, also the amount of droppings from the stock and the residue to be ploughed under during the spring. The ameliorating effects of the more vigorous root system upon the subsoil is of considerable importance.

The advantages of mixing rape and barley by sowing in alternate drills are that a greater amount of fodder is grown, say, from 10 acres mixed than from 5 acres each of barley and rape. Both barley and rape have an independent initial start, which is not possible when mixed indiscriminately; the root systems are different, the barley having a fibrous surface feeding system, whereas the rape sends its tap roots into the subsoil. The fibrous surface roots of the barley assist in preventing the soil from getting out of condition by tramping, and is preferable to rape in this respect; the mixed diet is more acceptable to stock and more wholesome, and the partiality of stock for the barley minimises the risk from hoven, which is ever present when rape is fed alone.

Both barley and rape require the land to be in good condition to give satisfactory results, and it is for such land that it is strongly recommended. Barley grows better during the very cold weather than rape. Rape has the advantage over barley in ameliorating the subsoil by the action of its tap roots; it also provides a large quantity of readily decomposable matter to be ploughed under in the spring or early summer.

Upon the poorer soils, black-winter rye should be sown with the rape instead of barley. It is unquestionably the very best to provide fodder from soils that are poor or out of heart. Under such conditions the rye has the advantage over the rape, and provides by far the greater amount of fodder. Notwithstanding this, it is advisable to sow the both for the reasons cited above.

Rye will thrive upon poorer soils and grow during colder weather than either barley or rape, and for this reason is invaluable as a winter fodder upon the light lands of the colder districts of the State.

It should receive far greater attention than it gets at present. Stock relish it more before it comes into ear, and it should not be allowed to get old before grazing.

To obtain the best results from such crops their production must go hand in hand with rational stocking. Paddocks which are continuously grazed will not carry half the stock as when fed off intermittently. Suitable subdivisions should be arranged. Two or three weeks are quite long enough to continuously graze a crop; the stock should then be taken out and placed upon another area. It should be so arranged as regards acreage and subdivisions that the first paddock grazed will have made from 6 to 9 inches of second growth when the last is eaten bare. Care should be taken not to turn stock into a paddock too soon. The crop should have made sufficient top and root development to prevent the surface soil being tramped out of condition. For this reason the practice of sowing rather thickly in drills 7 or 8 inches apart is preferable. When the drills are wide apart the sheep make paths between, and tramp by far too large a proportion of the soil out of condition.

When the fodder is grown to be carted from the field, the greater distance between the drills is very desirable.

The keeping up of the fertility of the soil should not be lost sight of, and it is very false economy to eat everything off the paddocks before ploughing.

Towards the end of the spring 2 to 3 feet of green crop should be turned under, to improve the texture of the soil, to improve its water-holding capacity, to provide carbonaceous matter for the micro-organisms, and form readily-assimilable plant food for the succeeding crop.

Stock on too many farms have aided the depletion of soil fertility instead of assisting in retaining it, owing to the inane practice of eating every green bite before ploughing.

The above-mentioned crops, when sown in February, allow of stocking during the autumn, winter, and early spring, when fodder, generally speaking, is scarce; having repaid the farmer handsomely during this period, they allow of considerable residues being ploughed under sufficiently early to leave the soil in the best possible condition to receive and retain the summer rainfalls.

This provision frequently ensures maximum results from the ensuing crop.

There are other crops, but in my opinion they cannot compare with the above from a practical commercial standpoint for the production of winter fodder in this district.

Stock Shelters.

At this season of the year the necessity of some form of stock shelter is forced upon us.

In summer time stock suffer from the hot rays of the sun and may be seen in the effort to obtain shelter from the fences or trying to make the most of the shade of the bank of some dry creek. Birds with open beaks and outstretched wings find no shelter but from posts and rails.

Upon many holdings this absence of shelter from winter wind and scorching heat is hard to understand. Around the homesteads may be seen considerable plantations of most suitable trees, yet in but few instances are clumps for stock shelter to be seen in the paddocks. There are many large tracts of naturally-exposed country which have been added to considerably by the axe of the settler. Unfortunately in the past the axe has not in many instances spared sufficient of the indigenous trees to provide clumps for adequate stock shelters.

Under Australian conditions, generally speaking, trees and grass do not grow satisfactorily together. The axe is the forerunner of sweet pastures, and its indiscriminate use has made imperative the artificial provision for the sheltering of stock, when a little forethought would have rendered such unnecessary. It is so easy to fell a tree, and so hard to make up one's mind to plant one. For suitable shelters for summer and winter, evergreen quick growers are essential. *Pinus insignis* and the large privet (*Ligustrum lucidum*) have proved hardy and quick growers under the conditions of this district, and are recommended for the purpose. The pines should be planted

Shade and shelter plantation at Bathurst Experiment Farm.

about 24 feet apart, and the privet about every 3 feet between. The shrubby habit of the privet provides shelter between the trunks of the pines. Stock and rabbits are fond of the privet, and they must be adequately protected.

Ridges of such trees are satisfactory, as they allow of shelter from any quarter and possess no corners in which stock may injure each other. Trees planted in corners of paddocks or in acute angles are a mistake, and the price paid for such may be the broken leg of a horse or the lost quarter of the cow's udder. Clumps in the open are much more satisfactory.

If the most is to be made of any pasture, the stock should be made comfortable. In cold climates, a considerable amount of the pasturage is required to make good the loss of animal heat due to exposure, and if this were more generally recognised there would be more trees lending beauty to the landscape and comfort to the flocks.

Autumn is generally the best season to plant out shade and shelter trees and shrubs, and arrangements should be made as early in the year as possible, to prepare the land for the trees by breaking up a fairly wide strip of soil.

Potato-Spraying at the Grafton Experiment Farm.

As there appears to be some very exaggerated ideas in regard to the cost of spraying, some experiments were here carried out to ascertain the cost per acre.

On the 10th November 2 acres were treated with Bordeaux mixture, with a view to supply this information.

Considering that a suitable spraying outfit is necessarily expensive, it would be much to the advantage of small growers to co-operate, and purchase an outfit much the same as the one utilised here. Cheap knapsack spray-pumps are a delusion, and altogether unsuitable for this work. One of the

most important factors is to have a powerful pump. The cost of the application of sprays depends entirely upon the outfit used. Below is the cost, &c., of the one here :—

	£	s.	d.
1 spray-pump...	5	7	6
12 feet ¾-inch hose, at 9½d.	0	9	6
20 feet ½-inch hose, at 8d.	0	13	4
2 only Y pieces, at 5s.	0	10	0
6 caps and lining, at 1s.	0	6	0
4 single-spray nozzles, at 4s. 6d.	0	18	0
2 brackets, at 2s. 6d.	0	5	0
4 clamps, at 1s. 6d.	0	6	0
Extra—4 single-spray nozzles, at 4s. 6d.	0	18	0
1 only 100-gallon vat, with lid, and galvanized-iron hoops	2	18	4
	12	11	8
Freight	0	15	0
	£13	6	8

Amount of Bordeaux mixture used, 100 gallons, in the proportions of 6 lb. bluestone, 4 lb. lime, and 40 gallons water.

	s.	d.
Labour—2 men, 3 hours, at 9d. per hour	4	6
1 horse ,,	1	0
Cost of Bordeaux mixture	3	6
Total cost for 2 acres	9	0

The actual time taken to treat the 2 acres was one hour, the remaining time (two hours) being taken up in preparing the Bordeaux and transit. I therefore estimate the capacity of this outfit at 6 acres per day, and the cost at 3s. 11d. per acre, working under this farm's conditions.

Under ordinary farmers' conditions the cost could be reduced, as, for instance, the preparation of the mixture could be done at night. Three applications would generally be sufficient, it is thought, to ward off disease; but this depends upon climatic conditions.

In spraying for Irish blight, the Director of the Bureau of Microbiology in the *Agricultural Gazette* for November last points out that the important thing is to get the spray on the under side of the leaf. This is a difficult matter; but with the use of a powerful pump, and the formation of a good spray, the vapour that ascends will come in contact with the under side of the leaves to some extent. As spraying (in conjunction with clean seed and fresh ground) is the only known means of combating Irish blight, the cost of spraying need not deter farmers from applying the preventive, as, once the sprayer is supplied, the cost is not a large item.—A. H. Haywood, Manager.

Cultural Methods for Wheat-growing in Dry Districts.

[Continued from November, 1909.]

GEO. L. SUTTON.

III.

Rotation of Crops.

In foregoing sections of this article I have endeavoured to show how two-thirds of the cultivated land can be advantageously cropped in any one year. This is a gain when compared with the ordinary system of fallowing, under which only one-half the land is under crop. Put in another way, the system of fallowing as usually practised, permits of three crops being obtained in six years, whilst under the system advocated four crops are obtained in the same period. It is true that two of these crops are fodder crops, but who will venture to say that the money value of the two fodder crops does not exceed that of the single wheat crop. And this, quite apart from the fact that under a system which provides for the growth of fodder crops, the fertility of the land is maintained, whilst under the other system the fertility is being reduced.

With the rotation referred to, the first three principles governing a suitable rotation are observed by the inclusion of fodder crops. The efficiency and value of such a rotation is further increased if the order in which the fodder crops are grown is systematically changed, so that the land which, in the first period of the rotation is cropped with Rape, is in the next period cropped with Cowpea, and in the final period with Sorghum.

It must not be inferred from the foregoing that the three crops named are the only ones that are available, or are likely to prove suitable for adoption with the methods advocated. If these crops do not satisfy a farmer's requirements, or fit in with his practice, he should not grow them, however desirable it may theoretically appear for him to do so. Unless a crop has a direct or indirect market value, a farmer should not grow it. It is unsound business practice for him to do so.

The object of growing such crops is to enrich the soil with nitrogen, to add organic matter to it, and at the same time prevent the ground becoming "sick" with any one crop, by growing a variety of crops. Providing these objects are achieved the actual character of the cropping is immaterial. There is no need to be confined to the crops referred to. Amongst other crops, Barley or Peas may be substituted for Rape, and Rye or Oats for Sorghum. As time goes on, other avenues of cropping will surely be opened up and new crops found, so that in the future the farmer will have an increased number of crops from which to make a selection.

The fourth principle governing a rotation is observed by arranging the work as in the following table, which shows the character of the crop, the condition of the soil, and the work being done on the different portions of the cultivated land, during any month of the three years during which the rotation runs.

A Table of the Farm Operations and Cropping during the course of the rotation :—

1908.						
January ..						Fallow.
February ..	Fallow.					
March ..			Wheat stubble.		Cowpeas—Sorghum.	
April ..	Planting Wheat					
May ..						Rape.
June ..						
July ..	Growing crop.				Ploughing.	
August ..			Ploughing.			
September ..						Ploughing.
October ..						
November ..	Harvesting hay and grain.					
December ..						
1909.				Fallow.	Fallow.	
January ..			Cowpeas—Sorghum			
February ..						
March ..	Wheat stubble					
April ..					Planting Wheat.	
May ..						
June ..				Rape.		
July ..	Ploughing.				Growing crop.	
August ..			Ploughing.			
September ..				Ploughing.		
October ..						
November ..					Harvesting.	
December ..		Fallow.				
1910.			Fallow.			
January ..	Cowpeas—Sorghum					
February ..					Fallow.	
March ..						
April ..			Planting Wheat.			
May ..		Rape.				
June ..						
July ..	Ploughing.		Growing crop.		Ploughing.	
August ..						
September ..		Ploughing.				
October ..						
November ..			Harvesting.			
December ..						
1911.	Fallow.					Cowpeas—Sorghum.
January ..			Wheat stubble.			
February ..					Rape.	
March ..						

It may be thought that the system outlined entails considerably more labour and expense than the method usually followed when wheat is grown continuously. Such, however, is not the case; under both methods the ground is ploughed once for the preparation of the seed-bed, but with the difference that, under the system advocated, the ploughing is done after the planting operations are completed, instead of (as under the ordinary method) before they are commenced. Under the modern system the cost of ploughing is reduced to a minimum, because it is done when the weather is favourable and the soil in the best condition for such work. Under the method which requires the ploughing to be done just before seeding starts, it is often done with difficulty, or is delayed waiting for an opportune fall of rain. Such a plan necessitates great haste at this season, for both the ploughing and seeding have to be done in a limited time, and, in consequence, there is an inducement to do the ploughing in a hurried and possibly slovenly manner.

Under the modern system, the cultivation of the fallows involves extra work, but this is almost universally acknowledged to be profitable work, and seeing that this work is helping to prepare the seed-bed, in consequence of which reploughing is unnecessary, and that the ploughing was done when it could be done economically and easily, it is questionable whether the cost of

preparing a proper seed-bed under the modern way is much greater than when the ordinary methods are adopted. Even granting that some extra labour is necessary, such is more than compensated for by the advantage of being able to plant the seed at the most suitable time, and have it germinate irrespective of an opportune fall of rain.

Another disadvantage connected with the ordinary method of growing wheat is, that the work of the year is crowded into seven or eight months, *i.e*, during February, March, April, and May, when the ploughing and planting is done; and during October, November, December, and January, when the harvesting is done Under the modern system the work is more evenly distributed throughout the twelve months, as the result of doing the ploughing in the winter and spring. The way in which this distribution is effected can be seen from the following calendar of the operations involved:—

CALENDAR of Operations, with Methods as suggested:—

January.—Working fallows; harvesting sorghum.
February.—Planting rape; working fallows.
March.—Planting rape; working fallows.
April.—Planting wheat.
May.—Planting wheat.
June.—Ploughing.
July.—Ploughing.
August.—Ploughing.
September.—Ploughing.
October.—Planting cowpea, sorghum; harvesting wheat for hay.
November.—Harvesting wheat for grain and working fallows.
December.—Working fallows.

Fig. A.
An Experiment Crop, Coolabah Experiment Farm, 1907. During its growing period this crop received 292 points of rain. The average yield of the plots was between 19 and 20 cwt. of hay per acre.

Fig. B.
An Early Sown Crop of "Medeah" Wheat, June, 1908. This crop was planted early in March, and from then until the illustration was taken 258 points of rain had fallen.

This calendar shows that profitable employment throughout the year is provided for most, if not all, of the men required to deal with the harvest. This is a step forward, and is all in the direction of securing better and more intelligent labour for agricultural work. Intelligent and skilful men are

Fig. C.
An Experiment Crop, Coolabah, June, 1908. This crop was planted in April; from planting to date of illustration the rain recorded was 149 points.

Fig. D.
An Experiment Crop (Fig. C) ready for the Binder, October, 1908. Rainfall during growth, 544 points.

now necessary in order to satisfactorily handle the useful, but expensive, machinery necessary for profitable wheat-growing. But the best class of men will never be induced to take up an agricultural life if the most that can be offered to them are engagements of a spasmodic character. The illustrations of the crops at the Coolabah Experiment Farm depict some of the results which, during the last five years, have attended the adoption of the methods described, and these results indicate the degree of success which is likely to follow their adoption in other districts.

Fig. E.
An Experiment Crop (Figs. C and D) in Stooks, October, 1908.

Fig. F.
A "Bare Patch" in the Young Wheat at Coolabah. This failing growth is due to some natural characteristic of the soil.

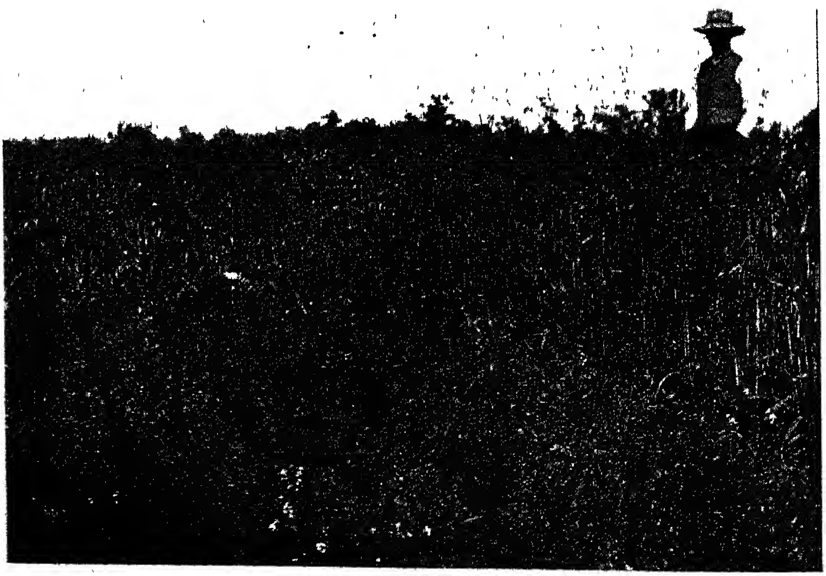


Fig. G.
A "Bare Patch" in the Mature Wheat at Coolabah Experiment Farm.

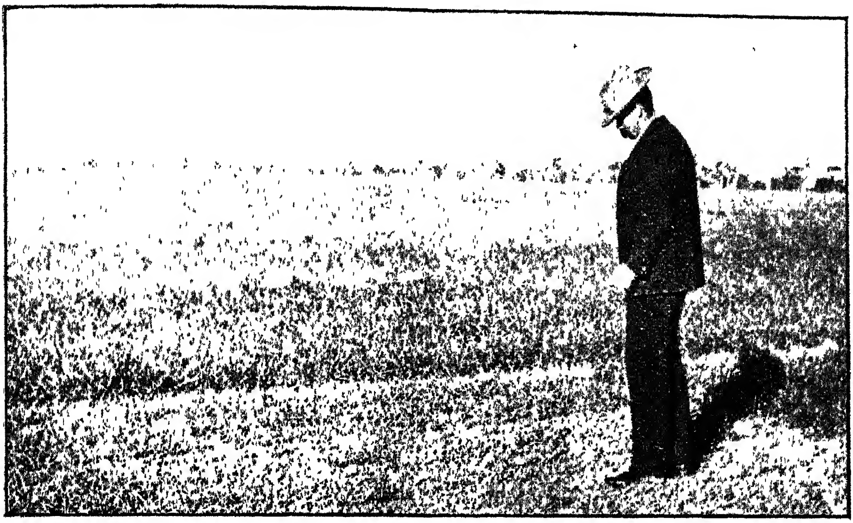


Fig. H.
A "Bare Patch" and Its Remedy. The "bare patch" terminates abruptly at the boundary of the plot to which superphosphate has been applied.

It may be thought that the soil at the Coolabah Experiment Farm is exceptionally rich or specially suited for the cultivation of wheat. Such is not the case; it is typical "West Bogan" (red) land, and peculiar difficulties have had to be overcome in dealing with what, for the want of a better term, are called "bare patches." These "bare patches" occur irregularly throughout the cultivated area. They are illustrated in Figs. F, G, H.

The cause of these bare patches is unknown, but our experiments show that an application of 50 lb. per acre of superphosphate causes them to disappear. This is shown in Fig. H. That illustration shows how abruptly the bare patches terminate at the boundary of a plot to which superphosphate has been applied. The position of the hat indicates the bare patch in an unmanured plot. The adjacent plot in which Mr. Kelly is standing was manured with 50 lb. of superphosphate, and in that plot the growth is quite good and normal. Under natural conditions the "bare patch" never terminates as abruptly as it has done in this case.

In conclusion, it is pointed out that modern methods are systematic, and mean fewer failures, permanent fertility, and increased returns from better crops, cleaner crops, more stock, and less losses.

THIS series of articles is being reproduced in the form of a Farmers' Bulletin, copies of which may be had, free, on application to the Under Secretary, Department of Agriculture, Sydney.

Feeding of Pigs.

[Continued from page 875, Vol. XX.]

H. W. POTTS, Principal, Hawkesbury Agricultural College.

XIV.

The By-products of the Dairy.

Skim-milk; Buttermilk.

In Australia, where dairying has become a permanent industry with an expanding export trade in dairy products, the by-products form a valuable source of food supply for pigs. Pig-raising is intimately associated with nearly every phase of dairy work.

Skim-milk, buttermilk, and whey possess in their composition all the elements for flesh production. In the two former almost the whole of the protein and carbo-hydrates of full milk are available. Whey contains much less of these nourishing constituents, and, in fact, can only be regarded as a food affording one half the feeding value of skim-milk and buttermilk.

Not only are the feeding properties of this class of pig feed well balanced, but continued experience as well as systematic investigation has amply proven that whenever a special class of food has become stale and unpalatable through continued use, the addition of these dairy by-products has shown a stimulating influence on the digestive processes. Their inclusion renders the ration more relishable, and the animal shows a marked improvement in flesh gains. Furthermore, wherever this class of pig food is available, a better flesh is the result; flavour, texture, and condition are distinctly enhanced. It is owing to this that we hear the consumer invariably ask for dairy-fed pork.

The pig-owner's aim is to secure a regular supply of dairy by-products and to combine them in an intelligent manner with cheaper foods, which by themselves afford a poor return, but with the dairy foods not only render the main supply of food possible, but appreciably tend to make the pigs healthy and thrifty.

One of the most popular of stock journals, *Hoard's Dairyman*, has published a rule to approximately estimate the value of feeding skim-milk alone to pigs and again with maize.

"Multiply five pounds of gain by the price of live-weight pork in the local market, or, if fed with maize-meal or barley-meal, credit one pound of increased gain to the skim-milk."

If the live weight of pork be worth 2½d. per lb., we have 1s. 0½d. per 100 lb., or ten gallons for the skim-milk when fed alone, or if fed in conjunction with maize-meal or barley-meal, six pounds of gain or 1s. 3d. per 100 lb.

The basis laid down by the Experiment Stations in the United States is that a bushel of maize (56 lb.) will give 10 lb. pork, and 100 lb. (10 gallons) skim-milk, 5 lb. of pork.

We would naturally assume when given together the result would be 15 lb. pork, but, owing to some unexplained reason, when these foods are fed together the actual result is 18 lb. pork.

Evidently the digestive organs are encouraged to greater activity by the combination.

The lesson is obvious that in order to secure the highest returns in feeding skim-milk, buttermilk, or whey, associate them with other foods such as maize, barley, oats, wheat, rye, millets, sorghums, peas, potatoes, roots, pasturage, pollard and other mill products.

Under these conditions the pigs eat more food daily; what they eat is better relished and assimilated. The daily gain is profitably increased, the fat is less, and the quality and flavour of the flesh is better as pork or bacon.

Skim-milk fed alone is not satisfactory, and in unlimited quantities its use is only justified with young stock when with the mother, or immediately after weaning.

Considerable misapprehension exists as to the wisdom of feeding sour milk or sour skim-milk to pigs. In Denmark, the United States, and in Australia it is a common practice. Systematic tests were conducted at the Vermont Experiment Station, to obtain definite data. In the Sixth Annual Report the following conclusion is arrived at:—

"The difference in the results obtained from feeding sweet skim-milk and sour skim-milk is so little that not much can be claimed in favour of sour milk, nor do we desire to claim any advantage from its use. The object of this experiment has been attained when it is shown, as these two years' work do show most conclusively, that sour skim-milk is at least equal in feeding value to sweet skim-milk."

Buttermilk.

Where buttermilk is undiluted it may be classed as equal in feeding value to skim-milk. Large numbers of pigs are fattened throughout the Commonwealth in close proximity to our butter factories.

The quality and condition of the buttermilk from such factories varies considerably. This is due to methods of churning and washing the butter, the inclusion in the vat of slops, washings, drainage, &c. Moreover, there may be salt, soda, lime, and other substances allowed to flow into the vats, which have an unhealthy influence on the pig and retards growth.

To secure the true feeding value of buttermilk, those who purchase the year's supply from factories should exercise care to see that they have buttermilk only to deal with.

Whey.

As with the previous by-products, whey may be only considered a suitable food for pigs when mixed with other foods.

When fed without, it is liable to produce stiffness in the joints and lameness.

This can be soon detected, as the first symptom of the use of whey being contra-indicated is that the animal suffers from scours.

Again, it must be recalled that whey has only half the feeding value of skim-milk and buttermilk.

Further, it is readily decomposed, and considerable care must be exercised in seeing that it is given fresh to pigs, and in a clean condition.

When given with other foods containing a high percentage of protein, it will afford a profitable ration.

In giving any dairy by-product to pigs, more especially young animals, the danger is ever present of conveying the organisms responsible for tuberculosis.

It should be laid down as a duty to pasteurise or scald all milk products used for feeding pigs, *i.e.*, to submit them to a temperature of about 180° F. for twenty minutes.

Average Composition.

	Water.	Mineral Ash.	Protein.	Carbo-Hydrates.	Fat.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Skim-milk	90·6	0·7	3·1	5·3	0·3
Buttermilk	90·1	0·7	4·0	4·0	1·1
Whey	93·8	0·4	0 6	5·1	0·1

At the Ontario Experiment Station, in Canada, the following test was conducted :—Sixty pigs were divided into five groups, all of which were fed alike for 120 days on a mixed meal ration. With the meal, the first group was fed skim-milk, the second group buttermilk, the third group ordinary whey, the fourth group separated whey, and the fifth group water. Without going into the detailed figures, it may be said that it took 254 lb. of meal and 626 lb. of skim-milk to produce 100 lb. increase in weight, this food giving the best economic result, as well as the largest average daily gain (1·36 lb.) per pig. Second to this came 256 lb. of meal and 631 lb. of buttermilk per 100 lb. increase in weight, the average daily gain per pig (1·32 lb.) being close on the first. Third place was taken with 169 lb. of meal, and 747 lb. of ordinary whey, the average daily increase per pig being 1·16 lb. Last place was taken by 297 lb. of meal and 774 lb. of separated whey for each 100 lb of weight increase. This gave a daily average increase per pig of 1·07 lb. When water alone was fed, it took 430 lb. of meal to produce 100 lb. increase, the average increase per pig per day being 0·7 lb. "If we represent the feeding value of separated whey by 100," the report states, 'the feeding value of ordinary whey would be approximately 125, buttermilk 160, and skim-milk 163·5; that is to say, ordinary whey showed a feeding value 25 per cent. higher than that of separated whey, buttermilk

60 per cent. higher, and skim-milk 63½ per cent. higher." It is also noted that the feeding value of each kind of whey, compared with skim-milk, was much higher in this experiment than in any other experiments ever conducted at the station, and a great deal higher than might ordinarily be expected. As ordinarily fed, whey seldom shows a value higher than one-half that of skim-milk or buttermilk.

Molasses.

In order to stimulate continuous growth the pig requires a relishable change of food, and whilst the main article of diet may be suitable and well-balanced yet some addition may be required to render it tasty and prevent the flavour becoming stale.

To this end we have a cheap and desirable class of food in the by-products of the sugar mills.

Molasses when fed alone or in excessive quantities is liable to produce a flesh with a distinct flavour that does not appeal to the consumer.

The use of molasses is not contra-indicated in consequence. It simply means that it should be fed with other classes of food in such proportions as will make the ration palatable.

Molasses may well be included in the dietary of the pig.

The food nutrients of cane molasses are about equal to those in maize.

Salt.

The object of making salt available for pigs is to impart flavour and relish to food, to excite appetite, and promote digestion.

In the latter case it stimulates nutrition by inducing a greater assimilation of protein.

In all cases, however, salt must be given with reasonable caution.

In small quantities, given regularly, there can be no objection to its use, and in fact it is essential, but many by-products such as kitchen refuse, slops from eating-houses, refreshment rooms, hotels, public institutions, and ships, including salt pork, salf beef, and fish, contain abnormal quantities.

On several occasions an alarm has been raised against the use of salt for pigs, owing to cases of sudden illness, and often with fatal results, being traced to excessive quantities of salt being fed. [See Diseases of Pigs, "Salt," *Agricultural Gazette* for December, 1909.]

Wood Ashes, Coal Ashes, Charcoal, and Lime.

At times pigs are observed to develop unnatural cravings. They eat up all sorts of rubbish lying within reach, and it often points to some deficiency of a special nature in the feed. In such case it is a good plan to place in the pens or paddock wood or coal ashes or charcoal, also lime and rock-salt.

Pigs will help themselves to these adjuncts to feeding in such quantities so as to satisfy their needs.

The pig responds readily to a variety of foods, and to study his appetite successfully means profitable gains.

FEEDING CALENDAR.

FOR FODDER CROPS SUITABLE FOR PIGS.

Crops to Grow.

Spring Planting.

Sorghums
Maize
Cowpeas
Mangolds
Sweet Potatoes
Artichokes
Lucerne
Pumpkins and squashes
Melons
Millets
Potatoes.

Summer Planting.

Maize
Sorghum
Turnips
Millets
Cowpeas
Soy Bean.

Autumn Planting.

Kale
Kohl Rabi
Cattle Cabbage
Rape
Vetches
Barley
Lucerne
Oats
Grasses
Wheat for grain
Potatoes
Clovers
Rye
Swedes.

Winter Planting.

Oats
Peas
Wheat for green feed
Barley
Rye.

Monthly Planting Calendar.

These particulars apply specially to the Hawkesbury-Nepean District; but, with slight modifications, all the directions concerning the more important foods will apply to most of the principal dairying and pig-farming districts.

January.

Rhodes grass
Couch grass
Paspalum dilatatum
Sheep's Burnet
Lucerne
Cowpea
Soy Bean
Maize
Millet
Sorghums
Sweet Potatoes
Pumpkins, Marrows, Rios, Grammas, &c.
Potatoes
Melons.

February.

Rhodes grass
Couch grass
Paspalum
Sheep's Burnet
Lucerne
Cowpea
Soy Bean
Maize
Millet
Sorghums
Potatoes
Sweet Potatoes
Pumpkins, Rios, &c.
Melons.

March.

Rhodes grass
Couch grasss
Paspalum
Sheep's Burnet
Lucerne
Cowpea
Soy Bean
Maize
Millet
Sorghums
Sweet Potatoes
Potatoes
Pumpkins, Rios, &c.
Melons.

April.

Rhodes Grass
Couch
Paspalum
Sheep's Burnet
Cowpea
Soy Bean
Lucerne
Barley
Maize
Millet
Sorghums
Rape
Turnips
Sweet Potatoes
Potatoes
Pumpkins, Rios, &c.
Melons.

Monthly Planting Calendar—*continued.*

May.

Toowoomba Canary Grass (Phalaris Commutata)
Texas Blue Grass
Cocksfoot
Rye Grass
Prairie Grass
Couch
Paspalum
Sheep's Burnet
French or Soulla Clover
Lucerne
Barley
Sorghums
Rape
Turnips
Sweet Potatoes
Potatoes
Pumpkins, Rios, &c.
Melons
Artichokes.

June.

Canary Grass
Texas Blue Grass
Cocksfoot
Rye Grass
Prairie Grass
French Clover
Field Pea
Turnips
Rye (Emerald)
Barley
Sorghums
Oats
Rape
Swedes, Turnips
Artichokes
Sweet Potatoes
Potatoes
Melons.

July.

Canary Grass
Texas Blue Grass
Cocksfoot
Rye Grass
Prairie
Sheep's Burnet
French Clover
Turnips
Rye
Barley
Oats
Wheat
Sorghums
Rape
Swedes, Turnips
Artichokes
Sweet Potatoes
Potatoes.

August.

Canary Grass
Texas Blue Grass
Cocksfoot
Rye Grass
Prairie

August—*continued.*

Sheep's Burnet
French Clover
Crimson Clover
White Clover
Lucerne
Field Pea
Vetches
Rye
Barley
Oats
Wheat
Rape
Kale
Kohl Rabi
Swedes
Cattle Cabbage
Turnips
Artichokes
Sweet Potatoes
Potatoes.

September.

Canary Grass
Texas Blue Grass
Cocksfoot
Rye Grass
Prairie
Couch
Paspalum
Sheep's Burnet
French Clover
Crimson Clover
White Clover
Lucerne
Field Pea
Vetches
Rye
Barley
Oats
Wheat
Rape
Kale
Kohl Rabi
Swedes
Turnips
Cattle Cabbage
Mangolds.

October.

Canary Grass
Texas Blue Grass
Cocksfoot
Couch Grass
Rye Grass
Prairie
Paspalum
Sheep's Burnet
French Clover
Crimson and White Clover
Lucerne
Field Peas
Vetches
Wheat
Barley
Oats
Kale

Monthly Planting Calendar—*continued.*

October—*continued.*

Swedes
Turnips
Mangolds.

November.

Rhodes Grass
Texas Blue Grass
Cocksfoot
Rye Grass
Couch
Paspalum
French Clover
Lucerne
Oats
Millet
Mangolds
Marrows.

December.

Rhodes Grass
Couch
Paspalum
Sheep's Burnet
Lucerne
Cowpea
Maize
Millet
Sorghums
Marrows
Squashes.

Name of Crop.	When available.
Vetches	August to October.
Field Pea	June to October.
Cowpea	December to April.
Soy Bean	January to April.
French Clover	May to November.
Crimson ,,	August to September.
White ,,	August to October.
Lucerne	September to May.
Rye (green feed)	June to September.
Barley ,,	April to October.
Oats ,,	June to November.
Wheat ,,	July to October.
Maize ,,	December to April.
Millet ,,	November to April.
Sorghum ,,	December to July.
Rape	April to September.
Kale	August to October.
Cattle Cabbage	August and September.
Kohl Rabi	August and September.
Swedes	June to October.
Turnips	April to October.
Mangolds	September to November.
Potatoes	December to August.
Artichokes	May to August.
Sweet Potatoes	January to August.
Pumpkins, Rios, &c.	January to June.
Melons	January to June.
Marrows, &c.	November to February.
Paspalum	September to May.
Canary Grass	May to October.
Rhodes Grass	November to May.
Texas Blue Grass	May to November.
Cocksfoot	May to November.
Rye Grass	May to November.
Prairie Grass	May to November.
Couch Grass	September to May.

Other Foods Available.

Silage.
Milk.
Skim-milk.
Buttermilk.
Whey.
Wheat meal.
Barley meal.
Oat meal.
Rice meal.
Rye meal.
Pea meal.
Bean meal.
Gluten meal.
Rape meal.
Linseed meal.
Buckwheat meal.

Other Foods Available—*continued.*

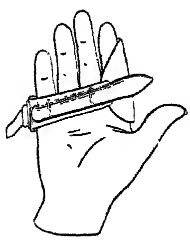
Maize meal.
Bran.
Pollard.
Linseed.
Arrowroot.
Linseed Cake.
Copra Cake.
Rape Cake.
Cotton Seed Cake.
Bones, crushed.
Bone Meal.
Meat Scrap.
Dried Blood.
Cooked Offal.
Residue from the manufacture of Meal Products.
Kitchen Refuse.
Brewers' Grains.
Malt Sprouts
Distillery Grains.
Molassine.
Molasses.
Refuse from Canning and Biscuit Factories and Mills, Bakeries, Confectionery Works, Markets, &c.
Vegetables.
Fruit.
Acorns.
Nuts.
Carob or Locust Beans.
Chestnuts.

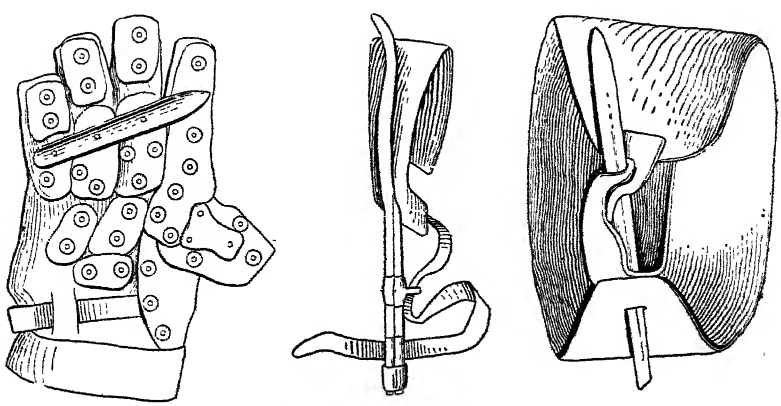
Adjuncts to Feeding.

Charcoal.
Wood Ashes.
Coal and Coal Ashes.
Salt.

Devices for Maize Husking.

The husking of maize cobs is one of the operations that still defies the inventor of agricultural labour-saving appliances. A good many maize-growers have adopted devices that serve to lighten in some degree this tedious manual labour. It is possible that some growers may find in the illustrations of a few American husking devices some ideas that might be adopted with good effect.





Devices for maize husking.

Government Stud Bulls available for service at State Farms, or for lease.

Breed	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm.	*
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ..	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Alstonville ...	*
,, ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
,, ..	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ..	Berry Melbourne	Melbourne ...	Rum Omelette	Mt. Irvine, Bell ...	*
Guernsey ...	Gentle Prince ..	Rose Prince ...	Gentle ...	Alstonville ...	19 Jan., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Wyrallah	13 May, '10.
,, ...	Star Prince ...	Calm Prince ...	Vivid ...	Alstonville District	*
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Paterson District	22 Jan., '10.
Red Poll ...	The Judge ...	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ...	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A. College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A. College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ..	Glen Innes Farm...	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	Obbe II ...	Obbe	La Shrapnel...	Wollongbar Farm	*
,, ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 3rd January, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

GUERNSEYS.—Lord Clatford: sired in England by Lord Clatford II, 1814; dam, Clatford Richesse, 6816 (imp.); calved 16th October, 1907; colour, lemon and white; price, £50. **Clatford Richesse is a fine type of dairy cow.**

Prince Illustrious: sire, Calm Prince; dam, Vivid II, from Vivid (imp.), **by Prince Moscow, by Rose Prince (imp.);** calved 8th March, 1909; colour, lemon and white; price, £40. **This is a great milking family, having the blood of Vivid and Calm, two great dairy cows.**

AYRSHIRE.—Scotland's Hope: sire, Jamie's Ayr; dam, Judica, **from Juliette, by Prince Emerald (imp.);** calved 21st February, 1908; colour, brown and white; price, £15.

JERSEYS.—Jack's Joy: sire, Sir Jack; dam, Rum Omelette II, **from Rum Omelette (imp.), by Golden Lord;** calved 4th June, 1908; colour, whole; price, £30.

Dreadnought: sire, Sir Jack; dam, Lady Kitchener, **from Egyptian Princess (imp.), by Lord Melbourne;** calved 22nd October, 1908; colour, whole; price, £20.

Calceolaria's Lad: calved 6th July, 1907; sire, Melbourne (imp.); dam, Calceolaria (imp.); colour, whole; price, £30.

DEXTER KERRY.—Mountain King: sire, Vesuvius; dam, Aicme Dear, **from Aicme Close (imp.), by Ham (imp.);** calved 10th March, 1909; colour, black; price, £8.

WOLLONGBAR EXPERIMENT FARM.

GUERNSEYS.—Life Buoy: sire, Admiral; dam, Keepsake, by Peter (imp.), from Souvenir (imp.); calved 15th March, 1909; price, £45.

Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909; price, £45.

HOLSTEINS.—Cronje: sire, Hollander; dam, Boswe; calved 4th February, 1909; price, £15.

Dutchman II: sire, Hollander; dam, President's Schot; calved 30th December, 1908; price, £10.

Applications for the bulls at Wollongbar Experiment Farm will be held till 21st January. If more than one application be received for any one bull, his disposal will be decided by ballot.

The prices indicated are at the respective farms, or on rail at Berry or Lismore.

H. C. L. ANDERSON,
Under Secretary.

Calendar for Fruit Districts.

W. J. ALLEN, Fruit Expert.

JANUARY.

Cultivation.

SHOULD rain fall during the month the soil should receive a thorough cultivation immediately it is dry enough, and all young trees would benefit by having the soil which may have been missed by the cultivator well loosened up. Where any weeds have made their appearance in the orchard the soil should be well stirred up with the cultivator—as all weeds, summer grass, &c., tend to rob the ground of the moisture which at this time of year is so badly needed for the trees and vines.

Irrigation.

Wherever water is available to irrigate fruit trees or vines, it is more than likely that they will require a thorough soaking this month. See that the water is confined to furrows, and be careful not to allow it to flood over any portion of the land; also that the best use is made of such water, and that none of it is allowed to run to waste.

After the soil has been well soaked, and as soon as the land is sufficiently dry to work, give it two deep cultivations in order to bring it to a proper state of tilth. Also see that all vines and trees are well worked around with a fork hoe while the soil is still damp. This will keep the ground from baking and prevent excessive evaporation.

Codling Moth.

See that all bandages are given careful and regular attention, and that all infested fruit is picked from the trees and ground, and destroyed by boiling or burning, in accordance with the regulations under the Fruit Pests Act. Give final spraying with arsenate of lead.

San José Scale.

Wherever it is found that trees are affected with this scale, they should receive a thorough spraying as soon as the crop is harvested, with the special resin wash. Leaflets can be had on application to the Department of Agriculture.

Prune trees affected with this scale at Wagga were successfully fumigated in the early part of November, without damaging either leaves or fruit; the work, however, was performed during the coolest part of the day, and the dose used was a little heavier than that shown in No. 2 Table for citrus trees. [See Departmental Leaflet No. 663, obtainable on application to the Under Secretary, Department of Agriculture.]

Red, Brown, and Indian Wax Scale on Citrus Trees.

Trees may be either fumigated or sprayed for the destruction of scale insects. This work may be commenced this month provided the trees are in good strong condition, but as this is usually a very hot month the work will have to be done on cool days or at nights, but never fumigate during the heat of the day at this time of the year.

Summer Pruning.

Wherever apple, pear, or apricot trees are found to have too much growth throughout the centre of the trees they should be thinned out, cutting back the superfluous growth to within about 3 inches of the main limbs or spurs from which they spring. This will open up the tree so as to admit light and air, which are necessary for the proper development and ripening of wood, as well as assisting the tree in its efforts to develop fruit spurs.

Reworking Old Trees.

The latter part of this month is the best time to bud to better varieties all poor or worthless varieties of fruit trees found growing in the orchard. Be sure that the buds to be used are taken from trees which have borne fruit of the very best quality. Insert them on the outer or underneath side of the limbs where it will be found that the bark usually raises more easily than on the upper side, and where they are more apt to form a well-shaped tree than where the buds have been inserted on the upper or inner side of such limbs.

Vines.

See that no suckers are allowed to remain on the vine, and in coastal districts it will be found advisable to top them where they are putting on strong growth.

Preparing for Cover Crops.

Do not forget to order black tares, peas, rape, rye seed, or whatever crop it is intended to sow for green manure between the trees. The seed should be ordered towards the end of this month, so that it will be on hand when required.

Marketing Fruit.

See that any fruit intended for market is not allowed to become too ripe before being picked, else by the time it reaches the consumer it will be in an overripe condition. Grade all fruit evenly and pack it neatly and securely, so that it will present a good appearance when put before prospective buyers.

February.

Cultivation may still be continued and in this way keep down weeds, as also the land in a state of tilth. The early part of the present month is a good time to bud to better varieties all poor and worthless varieties of fruit-trees.

Continue to fight the codling moth by picking up and destroying all moth-infested fruit, and give regular attention to the bandages and hand picking.

Towards the end of the month arrangements should be made for sowing leguminous crops such as are required for green manuring, and as the fall and winter are the only seasons when such crops can be grown among the trees, without robbing them of moisture, it is best to sow only such varieties as will make a fair growth during the cooler and cold months.

Harvesting of fruits will still be continued. Fruit for export will be ripe enough for picking and packing towards the end of this month or early in March. Send only the very best fruit. It should be well coloured, of good size, evenly graded, and neatly wrapped and firmly packed. The fruit should be picked and handled carefully in order to avoid bruising and should be kept as cool as possible from the moment it is taken from the tree until it is stored in the boat for carriage to Europe. Use good, strong, clean cases for holding the fruit, and have them stencilled neatly and legibly—as anything is not good enough, but only the very best.

Can, dry, and convert into jam all surplus fruits. Spray citrus trees for scale insects. Topping and tying of grape vines must be continued.

March.

The orchardist must bear in mind that this is the month for sowing peas, rape, vetches, rye, or any other crop which is intended for ploughing under in the spring, and the earlier they are put in the better. It will be found advisable to sow with such seeds about 80 lb. of superphosphates per acre, where the soil is in fair condition, and more than that quantity where the soil is poor.

Picking, grading, and marketing apples and pear.—See that all fruit is carefully picked, so as not to bruise it. Grade it evenly, then pack nicely in bushel cases, so that when opened up on the market it will present an attractive appearance. Market all those varieties first which are not good keepers.

Pears should be shipped to a moderate extent, as they always realise a good price when they arrive in good condition. As much as 30s. per case has been realised for some varieties. Winter Nelis pears usually carry best, and are also among the finest flavoured pears grown. Josephine de Malines is also good, as are also Beurré d'Anjou and Beurré Clairgeau. These are all good quality pears, and realise good prices when they arrive in proper condition. In our cool districts it is not a very difficult process to store some of our good-keeping varieties in cool rooms. At Bathurst we have kept apples for months by simply storing them on trays placed on shelves, but the most general method is to store in bushel cases and leave in the packing-house. When intended for export, the fruit should be picked in the cool of the day, or on cool days, and kept in the shade of the tree until it is carted to the packing-house. It should be kept as cool as possible until it is packed and ready for shipping: in fact the secret of success lies in careful handling, honest packing, and keeping the fruit at as low a temperature as possible. Never by any chance should the fruit be allowed to stand in the sun, nor be overripe before being picked. Generally, when the seeds are well coloured, the fruit is ready to pick, and if properly stored will keep without shrivelling—that is, if they are keeping varieties.

See that all infested apples, pears, and quinces are destroyed regularly, and all bandages attended to every seven to ten days, and all grubs found underneath such bandages destroyed.

Spray for scale insects. Get land ready for planting citrus trees. Budding of nursery stock may be practised in the early part of this month.

April.

Seasonable work in established orchards at this time includes the picking and packing for market, or storing of apples (late) and pears. A few weeks after the fruit is all gathered, the bandages should be taken from the trees, and be either boiled or burnt. Good stout bagging is needed as an effective trap for codlin moth, and any that answers to that description should be boiled and put away for future use. Thin, old, or rotten bagging should be destroyed at once. The trunks of most trees afford a hiding place for codlin grubs, therefore places likely to harbour this pest should be examined, and all grubs killed and any rough bark scraped off.

In cases where the grower intends to give his orchard two ploughings, the first should be given as soon as possible, otherwise the land should have a complete rest until the winter ploughing, when all weeds which may have grown will be turned under while green and before they seed.

Although, in a good many districts, it is getting rather late to sow crops among the trees, it is, however, best to put them in as early as possible now, rather than miss the season. Lime may be applied in cases where the soil is found to require it, particularly where it is sour, or wherever it is very heavy or sticky. After making the application of lime, see that is well worked into the surface soil.

Those who intend planting out new orchards should get the land cleared and subsoiled as soon as possible, and secure their trees. In planting apple-trees, see that they are all worked on blight-proof stocks, as trees worked on such stocks can be kept free from woolly aphis.

Store apples for winter. Mark trees you wish to re-work. Carry out any improvements. Spray for scales and red mites or fungous diseases before leaves fall.

May.

Where it is intended to plant deciduous trees, either as refills or planting out a new orchard, no time should be lost in getting the land into a fit condition to receive them. Land should be cleared, well fenced, ploughed, and subsoiled. Lay the orchard out properly, give the trees plenty of room so that there will be a sufficient area from which they will draw moisture to keep them in good growing condition during dry years. At time of planting cut all apple and pear trees down to within 1 foot of the ground, and other trees to within 15 inches.

Ascertain the varieties of fruits which find most favour on the markets, then select such kinds as will thrive best in your soil and climate. After planting, work, manure, and prune these in the most up-to-date manner. Do every part of the work thoroughly and you will not be disappointed in the ultimate results. Lime is beneficial to soils where they are sour.

From now until pruning is a slack time and it is well to give the orchard a good rest until that time. Stable manure can be carted in for weak trees. Drains, fences, gates, or any repairs necessary may be attended to.

Lemons and mandarins will soon be ready for picking.

Commence pruning in colder parts. Remove old dead trees. Spray for fungous diseases in deciduous trees. Trees may be planted this month.

JUNE.

In large orchards pruning may be commenced this month, otherwise there is no hurry until July. This important work should not be neglected if growers wish to get the best results. Judicious summer pruning combined with proper winter pruning will repay the grower handsomely for the labour incurred.

Do not forget to cut all trees hard back at time of planting. Refills in all deciduous orchards should be planted not later than the beginning of this month.

Many orchards would be greatly benefited by the application of lime, and the present is a very good time to apply same, so that it will have had time to act upon the soil before the spring manuring. Mark all weak and diseased trees when pruning so that these can receive special treatment. Leave all grapes to be pruned later, on account of late frosts. Attention should be given to fences, buildings, &c.

Busy time beginning for citrus growers. Main crop oranges and lemons ready for picking.

JULY.

The most important work during this month is the pruning. Pruners should bear in mind that wood growth is in inverse ratio to fruit, and therefore trees showing large amounts of wood growth will show less fruiting wood, and *vice versa.* Each and every tree has its own individuality, and therefore the grower should study the habits of the different trees and prune them in such way as will ensure them to return him the best fruit from year to year.

All refills should be planted without further delay.

When new orchards are to be planted the sooner they are in now the better—as the roots start growing this month—and the better hold they get on the ground in the early part of the season the stronger growth they will make during the summer. While pruning or working around the trees always keep a sharp lookout for any diseases which are liable to attack them, and mark any trees so affected. Burn all prunings as soon as possible. The most expeditious way to accomplish this is to mount an old tank on wheels with grating in bottom.

All wood cuttings for grafting should be laid in the ground.

Apply stable manures. In cold late districts plant late varieties of apples and pears for exporting. Citrus fruit handling, packing and marketing continued this month. Scrape and burn loose bark from apple, pear, and quince trees. Orchards should be kept in thorough order from 1st July to 1st April each year.

August.

Winter spraying should be commenced with the lime, sulphur, and bluestone solution, which is both an insecticide and a fungicide. Keep a sharp outlook for aphis on peach trees. Resin and washing soda, tobacco wash or nikoteen will be found useful to keep this pest in check. Also keep a sharp lookout for the appearance of woolly aphis and mussel scale, and should any trees be found affected they should be carefully pruned, removing and burning as many of the infested twigs as possible. Spray thoroughly with red oil emulsion.

Keep all fruit-houses as clean as possible, as there is no doubt they are responsible for harbouring a great many moths every year. Growers who intend using quick-acting fertilisers should make the first application this month. It is better not to apply too much at one time, but rather make two applications—one now, and one after the fruit is set. In the drier districts, where late rains are uncertain, it is better to make the application earlier than late, as it is well known that they do not give the same results if applied when the soil is at all dry.

The latter part of this month is a good time to start the grafting of deciduous nursery stock, and should there be any unprofitable apple, pear, or other trees standing in the orchard, these also may be grafted to good varieties.

It is surprising how few orchardists grow table grapes even for their own use. There is nothing more refreshing in the summer time than a bunch of grapes, and every orchard should contain a small plot. The best varieties to grow in a cool district are as follow:—White Royal Muscadine, Golden Chasselas, and Ferdinand de Lesseps, Black Hamburg, Black Champion, Blue Imperial, and Muscat Hamburg.

Green manures should be ploughed under, so that the plant food locked up in them may be available when the tree requires it to mature its fruit. If the green crop is left too late, moisture, which can ill be spared if the summer is a dry one, is pumped out. Plant young citrus trees.

September.

If the green crop has not been turned under, it should be done as early as possible, in order that the crop may become well rotted while there is still considerable moisture in the soil. If such crops are allowed to remain in until the land becomes dry, it will be found almost impossible to plough the soil, to say nothing of turning them under; and the chances are that, instead of doing good, the opposite effect will result, as the moisture, in place of being conserved, will have been taken up by the crop, in consequence of which the soil will have become hardened, and when ploughing is attempted the ground will break apart in lumps, and it will be found impossible to turn the crop under, which will thus dry up instead of rotting, as it should.

If the spring proves to be a wet one, it is advisable to spray trees which have in previous years shown signs of fungous diseases, such as peach curl in the peach trees, black spot or scab of the apple, and shot-hole fungus of the apricot. Bordeaux mixture will be found the best spray at this time of the year for all fungous diseases.

Should the San José scale put in an appearance after the leaves have started on the trees, the resin, soda, and fish-oil wash will be found the best to use at this season of the year; yet it may damage the fruit a little unless applied very weak. Never spray any trees or vines when they are in bloom, as the chances are that the crops will be destroyed. They may be sprayed a week before coming into bloom, and a week after the fruit is set. In all cases see that the orchard is in thorough condition, as the future crop depends so much on the condition in which the trees and soil are kept during the summer months.

It is well to make early arrangements for fighting the codling moth. It has been proved that four applications of Swift's arsenate of lead will control this serious pest. The first spraying should be given just as most of the petals have fallen. This is the most important spraying of the four. The quantity used is 4 lb. to 100 gallons of water. The second spraying to follow a fortnight to three weeks after the first, using 3 lb. of Swift's arsenate of lead to 100 gallons of water. Subsequent sprayings may be given at intervals of every three or four weeks if the moth is bad, using 3 lb. of Swift's to 100 gallons of water. In spraying trees with this, or any other spray, see that a good pressure is kept up so that the pump will throw a good fine mist, and be particular to cover the inside and outside of the tree as well as the whole of the fruit.

It is rather late for planting deciduous trees, even during the earlier part, yet, if they are given special care, such trees and vines may be planted. Careless handling is usually responsible for loss. If the spring proves to be a wet one, do not forget to use Bordeaux mixture for fungous diseases.

All soil should be loosened, either with a fork hoe, or chipping hoe, around trees and vines, and all couch grass, sorrel, or other weeds removed and burnt. This work should be carried out in the early spring, while the soil is moist and easy to work.

OCTOBER.

As the warm, dry weather will soon be upon us, it is important to see that all weeds and crops which have been allowed to grow between vines and trees should be turned under, and that all soil underneath such trees and vines has been well loosened. After each rain the soil should be worked up to prevent excessive evaporation, and under no circumstances should this necessary work be neglected. Where there is any neglect in cultivating during this and subsequent months, the orchardist need not feel disappointed should he lose his crops and possibly some of his trees. As all growers are compelled to keep their orchards free from codling moth, it may not be out of place to keep a strict look out for same, and where apparent spray with Swift's arsenate of lead. In spraying use as fine a nozzle as possible, the object being to cover the tree with a fine mist. It will be necessary to get the bandages for codling moth on the apple, pear, and quince trees, and these must be removed and examined every seven to ten days after the grubs have made their appearance, and all grubs and chrysalids destroyed. It has been found in practice that a copper nail is the best means for attaching bandages around the trees. Look out for apple scab. Keep all dormant buds and

grafts well disbudded, so that the bud may get away good and strong. No suckers or shoots should be allowed to grow below the buds. It is also essential that all stocks should be cut back properly. The cut should be slanting, being slightly lower on the side opposite the bud, and it is advisable to stake them, not only to prevent them being blown out, but to encourage a straight trunk. Where grafts have been put in old trees they must be tied to prevent being blown off. To do this a good stake should be tied to the branch grafted, and allowed to project a foot or more over the end, then as the graft grows it can be tied to it.

Keep a strict watch on all refills and young trees, and if these show any signs of wilting give them one or two buckets of water from time to time, until they get a good start. Disbud all newly-planted trees, leaving good shoots at least 4 inches apart along the trunk of the tree, but do not allow two or three shoots to start from the same place, but give each branch a separate hold of the main stem. While working around trees watch for borers on the trunks and branches, as it is very easy, when they are just starting their work, to cut away the bark and find them, in this way keeping the orchard free of this pest. Pruning of old citrus trees may be done this month.

November.

The most important work for this season of the year is cultivation. If neglected at this particular season there is very little hope of harvesting crops of fruit which will be payable. Cultivation is the one work which cannot be neglected, and without which no grower can hope to succeed. I would, therefore, urge on all our growers the necessity of keeping their land well worked up to a good depth, and under no consideration leave the ploughing too late in the spring, as during most seasons we require all the moisture which we can possibly conserve in order to keep the tree in a healthy and growing condition, so that in its turn it may be able to supply the fruit with the required nourishment to bring it to maturity, therefore, work the land in the early spring, and from that time see that it is kept loose by constant cultivation.

Summer pruning may be started this month, and it is well to go over and regulate the growth of all young trees, thinning and shortening back where required, that is where the tree is growing too thick, and pruning or pinching back, so as to keep the tree evenly balanced and symmetrical. This early summer pruning is more for young trees, to aid in directing the growth to that part of the tree where it is most required. December and January are the months for pruning old trees in order to force out the fruit spurs and buds. This has a most important bearing on the furnishing of fruiting spurs from the base to the tips of apple and pear trees. As most varieties are prone to bear near the tips, close pruning when the tree is dormant produces tree growth, but if fruit is desired a check to the tree whilst the sap is flowing freely, causes the tree to throw out fruit buds and spurs for the next season. The orchard should be kept free of any rubbish, which will harbour the codling moth, and the bandages placed around the stem of the tree to catch the grubs of same should be removed every seven to ten days, and all grubs killed. It is most important that all fallen fruit should

be picked up and destroyed. Continue spraying with arsenate of lead for codling moth.

Thin apricots and peaches. Early cherries will have to be marketed this month.

December.

Keep the cultivators moving this month, as all orchard land should be kept free from weeds, and to this end the horses and cultivators should have but little rest. Orchard land neglected at this time will soon be covered with a coating of summer grass and couch grass, which will take many a hard day's work to eradicate. Where there are bad patches of couch grass these should be ploughed up and harrowed on a very hot day, as the roots soon die when exposed to the sun.

Keep a strict watch on all bandages on apple, pear, and quince trees, and see that all fruit is picked up and destroyed either by boiling or burning, but not by burying it. Fruit fly is not so bad in the tableland districts as in the coastal, but it is in the interest of every grower to see that all grubs are destroyed.

Fruit such as cherries, apricots, and peaches will be ready to market this month. The grower should grade and pack these in the most attractive way, so that they will command good prices when placed on the market. Such of these fruits as are intended for dessert purposes are best handled a little on the green side, else when they reach the town or city where they are to be offered for sale, they will be overripe, in which case dealers will not buy them as they will not stand the repeated handlings necessary before reaching the consumer.

It is time to make arrangements for space in the boats if fruit is to be sent to Europe this coming fall. If codling moth is showing up badly give another application of Swift's arsenate of lead. Hand-picking of moth-infested fruit, from the tree, commences this month. This is a most necessary operation in the complete eradication of this pest. It is also a check on the spraying.

Price of Departmental Seed Wheat, Barley and Oats.

The Hon. the Minister of Agriculture has decided to place at the disposal of farmers as much as possible of the seed wheat of pure and approved strains produced at the Experiment Farms at Bathurst, Cowra, Glen Innes, and Wagga in the season of 1909. The price fixed is 6s. per bushel, and as the demand for this seed is already great, growers are advised to make application at an early date. Applications will be dealt with in order of priority. Applications from farmers not resident in New South Wales cannot be met until all requirements of local growers are fulfilled. The price to be paid by applicants from beyond New South Wales is 7s. 6d. per bushel.

There will also be a fair quantity of seed of pure strains of Malting Barley, Skinless Barley, and Oats.

The price per bushel paid for these will be Malting Barley, 5s.; Skinless Barley, 5s. 6d.; and Oats, 3s. 6d.; and the same conditions will apply as in the case of Seed Wheat.

SHORTHORN BULL FOR SALE AT GRAFTON FARM.

THE Hon. the Minister of Agriculture has decided to offer for sale at the Grafton Experiment Farm the young Shorthorn Bull, Pansy Lad, by March Pansy from Peach; price, £20.

The usual conditions governing the disposal of Departmental bulls will apply in this case.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Albion Park A. and H. Society	Hector G. Fraser	Jan. 19, 20
Kiama A. Association	R. Somerville	„ 26, 27
Gosford A. and H. Association	R. J. Baker	„ 28, 29
Wollongong A., H., and I. Association	F. W. Phillpotts	Feb. 3, 4, 5
Shoalhaven A. and H. Association, Nowra	Henry C. Rauch	„ 9, 10
Central Cumberland A. and H. Association	H. A. Best	„ 16, 17
Coramba District P., A., and H. Society	H. E. Hindmarsh	„ 16, 17
Alstonville A. Society	W. Monaghan	„ 16, 17, 18
Kangaroo Valley A. and H. Association	E. G. Williams	„ 17, 18
Queanbeyan P. and A. Association	E. C. Hincksman	„ 17, 18
Guyra P., A., and H. Association	P. N. Stevenson	„ 22, 23
Tumut A. and P. Society	E. H Vyner	„ 23, 24
Manning River A. and H. Association	S. Whitbread	„ 23, 24
Ulladulla A. Association	J. Boag	„ 23, 24
Bellinger River A. Association	S. S. Hindmarsh	„ 23, 24, 25
Gunning P., A., and I. Society	W. T. Plumb	„ 24, 25
Robertson A. and H. Society	R. G. Ferguson	„ 24, 25
Wyong Agricultural Association	Edgar J. Johns	„ 25, 26
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskins	Mar. 1 to 5
Narrabri P. and A. Association	W. H. Ross	„ 1, 2, 3
Tamworth A. Association	J. R. Wood	„ 1, 2, 3
Yass P. and A. Association	Will Thompson	„ 2, 3
Braidwood P., A., and H. Association	L. Chapman	„ 2, 3
Coraki A. and H. Society	D. Cameron	„ 2, 3
Bega A., P., and H. Society	W. A. Züegel	„ 2, 3, 4
Nepean District (Penrith) A., H., and I. Society	Percy J. Smith	„ 3, 4
Berrima District A., H., and I. Society	....	„ 3, 4, 5
Molong Agricultural Society	A. D. Millar	„ 8
Murrumburrah P., A., and I. Association	J. A. Foley	„ 8, 9
Bangalow A. and I. Society	W. H. Reading	„ 8, 9, 10
Central New England P. and A. Association (Glen Innes), National Show.	Geo. A. Priest	„ 8 to 11

Society.	Secretary.		Date.
Tumbarumba and Upper Murray P. and A. Society...	E. W. Figures ...	Mar.	9, 10
Quirindi District P., A., and H. Association... ...	W. Hungerford ...	,,	9, 10
Campbelltown A. Association	Fred. Sheather ...	,,	9. 10
Berry Agricultural Association	C. W. Osborne ...	,,	9, 10, 11
Mudgee Agricultural Society	H. Lamerton ...	,,	9, 10, 11
Warialda P. and A. Association	A. J. Devine ...	,,	9, 10, 11
Crookwell A., P., and H. Association...	M. P. Levy ...	,,	10, 11
Port Macquarie and Hastings District A. and H. Soc.	W. R. Stacy ...	,,	10, 11
Oberon A. and P. Society	W. Minehan ...	,,	10, 11
Newcastle A., H., and I. Association	C. W. Donnelly...	,,	10, 11, 12
Cobargo A., P., and H. Society	T. Kennelly ...	,,	11, 12
Dapto A. and H. Society	G. A. McPhail ...	,,	15, 16
Blayney A. and P. Association...	E. J. Dann ...	,,	15, 16
Cooma P. and A. Association	C. J. Walmsley ...	,,	15, 16
Inverell P. and A. Association...	J. McIlveen ...	,,	15, 16, 17
Armidale and New England P., A., and H. Association (Armidale).	A. McArthur ...	,,	15, 16, 17, 18
Gloucester A. Society	E. Rye	,,	16, 17
Coonabarabran P. and A. Association...	Geo. B. McEwen	,,	16, 17
Upper Hunter P. and A. Association (Muswellbrook)	J. M. Campbell ...	,,	16, 17, 18
Camden A., H., and I. Society...	C. A. Thompson...	,,	16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,,	17, 18, 19
Royal Agricultural Society, Royal Agricultural Show	H. M. Somer ...	,,	22 to 30
Southern New England P. and A. Association (Uralla)	W. C. McCrossin..	,,	22, 23
Kyogle P., A., and H. Society	P. C. Beer ...	,,	23, 24
Nambucca A. and H. Association	R. Turnbull ...	,,	31, April 1, 2
Gundagai P. and A. Society	A. Elworthy ...	April	5, 6
Adaminaby P. and A. Association	W. Delaney ..	,,	6, 7
Bathurst A., H., and P. Association	A. H. Newsham...	,,	6, 7, 8
Bowra A. Association	C. Moseley ...	,,	7, 8
Moree P. and A. Society...	D. E. Kirkby ...	,,	12, 13, 14
Richmond River (Casino) A., H., and P. Society ...	W. S. Rayner ...	,,	13, 14
Orange A. and P. Association	W. Tanner ...	,,	13, 14, 15
Upper Manning A. and H. Association (Wingham)...	D. Stewart, jun....	,,	14, 15
Luddenham A. and H. Society	W. Booth ...	,,	14, 15
Corowa P., A., and H. Society...	J. D. Fraser ...	,,	16, 17
Narrabri P., A., and H. Association	W. Malane ...	,,	19, 20, 21
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	,,	19, 20, 21
Wellington P., A., and H. Society	A. E. Rotton ...	,,	20, 21
Clarence P. and A. Society	T. T. Bawden ...	,,	20, 21, 22
Macleay A., H., and I. Association (Kempsey) ...	E. Weeks... ...	,,	20, 21, 22
Durham A. and H. Association...	Chas. E. Grant ...	,,	27, 28
Deniliquin P. and A. Society	L. Harrison ...	July	21, 22
Murrumbidgee P. and A. Association	A. F. D. White ...	Aug.	23, 24, 25
Ganmain A. and P. Association	J. H. Ashwood ...	Sep.	14
Temora P., A., H., and I. Association...	John Clark ...	,,	20, 21, 22

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Agricultural Gazette of New South Wales.

Wheat Conference.

A CONFERENCE of Departmental Officers was held at the Wagga Experiment Farm on the 12th January for the purpose of discussing matters in connection with wheat-growing.

There were present: Mr. H. C. L. Anderson, Under Secretary, Department of Agriculture; Messrs. G. Valder, Chief Inspector; G. M. McKeown, Manager of Wagga Experiment Farm; R. W. Peacock, Manager of Bathurst Experiment Farm; R. H. Gennys, Manager of Glen Innes Experiment Farm; G. L. Sutton, Manager, Cowra and Coolabah Experiment Farms, and Wheat Experimentalist; M. H. Reynolds, H. Ross, and W. R. Fry, Inspectors of Agriculture.

It was resolved that the wheat districts of the State be grouped together in the following divisions:—

1. Very dry and hot.—(Of which the Nyngan Farm is typical.)
2. Dry and hot.—(Of which the Wagga Farm is typical.)
3. Medium dry and hot.—(Of which the Cowra Farm is typical.)
4. Cool.—(Of which the Bathurst and Glen Innes Farms are typical.)
5. Coastal.—(Embracing those districts bordering on the coast, and which are specially subject to rust.)

It was further decided that only the following varieties of wheat should be recommended for cultivation during the year 1910:—

Variety.	Period of Planting.	Districts.
Bobs	Mid-season and late	Very dry and hot; dry and hot; medium, dry and hot; cool.
Bunyip	Mid-season and late	Very dry and hot; dry and hot; medium, dry and hot.
Cleveland	Early and mid-season ...	Cool.
Comeback	Mid-season and late	Dry and hot; medium, dry and hot; cool.
Federation	Mid-season and late	Very dry and hot; dry and hot; medium, dry and hot.
Firbank (for hay) ...	Mid-season and late	Very dry and hot; dry and hot; medium, dry and hot.
Haynes' Blue-stem (for hay).	Early and mid season ..	Cool.
John Brown ...	Early, mid-season, and late...	Coastal.
(for green stuff)...	Early	Very dry.
Jonathan	Early and mid-season ...	Cool.
Jumbuck	Early and mid-season ...	Very dry and hot; dry and hot; medium, dry and hot.
Marshall's No. 3 ...	Early and mid-season ...	Dry and hot; medium, dry and hot; coastal.
Medeah (for green stuff).	Early and mid-season ...	Coastal.
Rymer	Early and mid-season ...	Dry and hot; medium, dry and hot; cool.
Steinwedel (for hay)	Mid-season and early ...	Very dry and hot.
Thew	Early and mid-season, and late	Coastal.
Uppercut	Mid-season and late	Medium, dry and hot; coastal.
Zealand...	Early and mid-season ...	Dry and hot; medium, dry and hot.

The following varieties were selected as being suitable for continued experiments with wheats and manures at the Experiment Farms and the Farmers' Experiment Plots :—

Variety.	Period of Planting.	Districts.
Bayah	Mid-season and late	Very dry and hot; dry and hot; medium, dry and hot.
Cedar	Early, mid-season, and late ...	Cool.
Florence	Mid-season and late	Very dry and hot; dry and hot; medium, dry and hot.
Genoa	Early, mid-season, and late..	Cool.
	Early	Dry and hot; medium, dry and hot.
Huguenot	Early, mid-season, and late ...	Coastal.
Nutcut	Early, mid-season, and late...	Coastal.
	Mid-season and late	Very dry and hot.
Warren	Early, mid-season, and late...	Coastal.
Yandilla King ..	Early and mid-season ...	Very dry and hot; dry and hot; medium, dry and hot.

Three of these wheats are not "Farrer" wheats, and may be got in fairly large quantities from private growers. Unfortunately, the Department cannot supply large quantities of some of the others, owing to the disastrous fire which lately occurred at the Cowra Farm, when 20 acres of seed-wheat were destroyed, and the whole of the Cowra supply of "Florence,"—which Mr. Sutton prefers to all others—was lost. Special steps will, however, be taken to sow large quantities of these favoured wheats in order to meet next year's demands, which it is expected will be very heavy. In the meantime, progressive growers are recommended to make experiments themselves with as many as they can get. The large experience which has been obtained this season from the great number of Farmers' Plots has strengthened the judgment of the Farm Managers in regard to some of the wheats.

In the *Gazette* for March, Mr. Geo. L. Sutton, Wheat Experimentalist, will deal with the principal wheats mentioned.

Errata.

In the article on "Feeding of Pigs," by H. W. Potts, in our January issue, a Feeding Calendar is given on page 76. For the sub-heading in the middle of that page, "Monthly Planting Calendar," read "Monthly Feeding Calendar." We regret the error, which we fear must have puzzled some of our readers.

The same issue opens with an article on "Sheep and Wool for the Farmers," by J. Wrenford Mathews. Facing the first page is an inset illustration purporting to represent a flock of ewes, and the top illustration opposite page 4 is an alleged group of wethers. The letterpress descriptions beneath these pictures should be reversed, so that we may be spared from the criticism which the humorous mistake may generate.

Soils of New South Wales.

Part I.—The Soils of the South Coast.*

H. I. JENSEN, D.Sc., Chemist's Branch.

I.—Introduction.

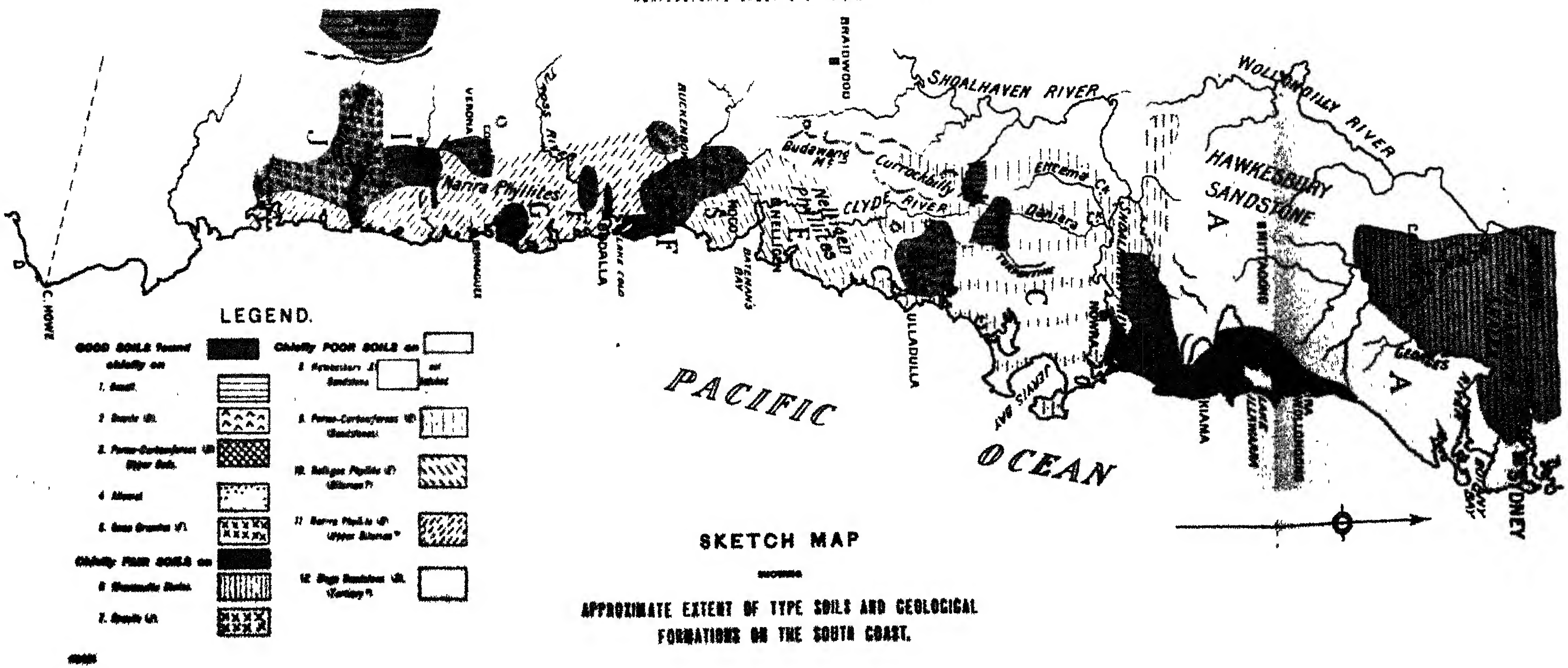
Various methods have been employed by surveyors and selectors to ascertain the agricultural value of land. One very commonly adopted, both in the United States of America and in Australia, is to judge the quality of the land by the assemblage of timbers growing upon it. In some regions the presence or absence of a particular timber is a sufficient clue. Another method is to base one's estimate on the nature of the rock-formation underlying the soil. Both of these methods are very good, and of wide application, and in some cases the one is superior, in other cases the other. Perhaps the most accurate means of determining the agricultural value of land is by careful chemical analysis, coupled with careful field observations on the depth of the soil and the nature of the subsoil.

In this paper attention is given to all of these methods, most reliance being, however, placed upon the chemical, and the main object of the research is to determine, with more accuracy than has hitherto been attained, the influence which geological formation has upon the quality of the soil in the district in question.

Naturally, a clear conception of the agricultural value of land in a farming district should enable us to form a more scientific idea of the true monetary value of the same land for purposes of land taxation and exchange. At present the purchasers and sellers of land have far from scientific notions in this regard, and in consequence land deals become little more than a speculative gamble.

Take, for example, this instance typical of many land transactions. A. owns a farm which he desires to let to a suitable tenant. He has cultivated this land twenty years, with little or no restitution of manurial ingredients to the soil, and has made a good living. However, he now finds that farming no longer pays; in fact, the land is exhausted. B. wants a farm, and is introduced to A., who shows him his books, which prove that for twenty years the land has given excellent returns. The intending lessee (or buyer, as the case may be) is very pleased, and offers a very high rent (or price). If he had been a cautious man he would have first asked himself whether the geological formation and topography were such as to give a soil which is capable of being cultivated for a long period without exhaustion, and he would have carefully sampled the soil and obtained an analysis. On taking the land B. may find that he is paying far too much in rent, and cannot

* A rough soil map, based on the geological map of the south-eastern parts of New South Wales, has been constructed to explain points emphasised in this paper. It has been found necessary to alter the official geological map in places. The boundaries are only approximate, and within each area there are numerous small patches of soil differing from the type soil of the area and geological formation. As these patches, consisting sometimes of alluvium, sometimes of basalt cappings, are very numerous, it would be foolish to attempt to insert them without a detail survey of the whole area. The Roman capitals indicate more accurately the nature of the soil and geological formation as explained in the text.



SKETCH MAP

SHOWING

APPROXIMATE EXTENT OF TYPE SOILS AND GEOLOGICAL FORMATIONS ON THE SOUTH COAST.

make a living on it. The same argument applies to land on which dairying has been carried on for a number of years.

It also follows that if A. sells a farm to B. for double its true value, land values in the district are unduly enhanced. If now B. lets the farm to C. and he wants 20 per cent. interest on his outlay, he increases the rent. Another man D. wants to invest in land, and is satisfied with 10 per cent. interest on his outlay. He is therefore content to pay B. even more for the land than B. paid A., and land values are still further enhanced. After a while D. begins to think that after all 20 per cent. is a fair interest, and he raises the rent still further. In this way it comes about that in many districts the tenants are in a pitiable plight. Scientific knowledge of the agricultural value of land will do much to check this tendency, which is so damaging to the primary industries of the State.

Changes in soil composition depend on three factors—(1) the chemical composition of the rock beneath; (2) climate; and (3) topography. In all regions having the same kind of climate, the same formation has the same soil in different localities, provided that the topography is similar.

II.—Topography, Physiography, and Geology.

A. *Hawkesbury Type.*—The South Coast, from Botany Bay to Stanwell Park, consists of sandstone country of the Hawkesbury type. The soils are therefore of poor quality, and similar to those described by Mr. F. B. Guthrie in his paper on "The Soils of the County of Cumberland."* No further description is therefore needed.

B. *Bulli-Berry Type.*—At Stanwell Park the underlying Permo-Carboniferous formations begin to appear at the surface, and from Clifton onwards, as far as Termeil, the coal measure formations extend in an uninterrupted series. The Bulli coal measures and upper beds of the Upper Marine, extending from Clifton almost to Nowra, have given rise to soils of fair quality. The rocks consist of sandstone, with calcareous cement, tuffy sandstones and mudstones (or claystones). Interbedded with these are rocks of igneous origin, like the Jamberoo tuffs, the Robertson basalt, Blowhole (Kiama) basalt, and Bumbo basalt. All these volcanic outcrops give rise to excellent soils.

Originally most of this country was covered with scrub (jungle), the remnants of which are to be seen in many places. The cabbage palm, which has in so many cases been spared by the axeman, is in itself an emblem of fertility. Farming and dairying are successfully carried on, specially favoured by good, deep, loamy soil and plenteous rainfall. As regards physiography, the country from Stanwell Park to Berry is a gently undulating strip lying between the mountains and the sea. In places a narrow extent of coastal flat intervenes between the sea and the undulating country.

C. *Jervis Bay Type.*—The area lying between Nowra, Jervis Bay, and Sassafras consists of the lower beds of the Upper Marine, chiefly conglomerates and coarse sandstones. These rocks are highly siliceous, and the

* *Agricultural Gazette*, Vol. IX, 1898, p. 481.

cementing material is not calcareous. Consequently the soil is extremely poor in plant-food; so poor, in fact, as to be almost useless and worthless for many years to come. In isolated places there are small outcrops of basalt, as at Sassafras, Tomerong, and in a few localities on Jervis Bay. These outcrops yield a fair farming soil, that afforded by the Sassafras basalt growing some of the finest potatoes in the State. Usually, owing to the smallness of the basaltic outcrops and their exposed position, the soils on them are very leached, and not nearly so rich in plant-food as might be expected. The Sassafras basalt forms a tableland on the top and eastern fall of Currockbilly Range, and the other outcrops form small hillocks projecting out of the sandstone level. Two types of soil are noticeable on the sedimentary rock. The hard siliceous sandstones and conglomerates give a wretched and extremely shallow soil, which, in exposed upland regions, is almost treeless, supporting only a low scrub of ti-tree, honeysuckle, bottlebrush, and other plants which usually accompany them. The grasses are mostly stiff reeds. The same rocks in less exposed and drier places carry a vegetation consisting of peppermint, white gum, spotted gum, ti-tree, honeysuckle, and occasional oaks. The grass-tree is very abundantly represented, and where the sandstones give the best-drained soils the grass-trees attain the greatest size. Where the soil is sour they often grow more thickly, but cannot produce a stem. The more shaly and fine-grained sandstones give a deeper and more loamy soil, with a clayey subsoil. The forest flora shows clearly the fact that this soil is superior to that of the more arenaceous series, for the timbers include sally, turpentine, white gum, spotted gum, ti-tree, and in places, where the shales are somewhat inclined, the zamia. Such country we have at Turpentine, on the Turpentine Range, and on the Jervis Bay road, 2½ miles from Nowra. It would make good orchard country, but there is unfortunately not much of it. The basaltic country at Sassafras is partly forest-covered and partly scrub. The forest contains bloodwood, box, white gum, and blue gum, and the scrub contains cedar and sassafras, amongst others. In the Jervis Bay-Sassafras belt the range is much further inland than in the Bulli-Berry area; consequently the coastal flat or plain forms a wider belt along most of the coast-line, rising gradually into undulating country several miles from the coast. The country of the Jervis Bay type extends south as far as Termeil, lying between the Pigeon House Range and the Currockbilly Range at Sassafras and the sea. It is interrupted at Milton by an outcrop of quite a different formation, covering an area several miles in radius.

D. *Milton Type.*—At Milton the dominant formations are augite-diorite and basalt, both of which yield excellent agricultural soils. The country is undulating and much is under cultivation, the rest being used for grazing and dairying. Potatoes, fodder crops, and the usual farm crops are successfully cultivated. The soils are dark in colour, and consist of heavy loams and clays of considerable depth and richness.

E. *Nelligen Schist Type.*—Beyond Ulladulla, from Termeil to Pollwombra Mountain, about 5 miles north of Moruya, the South Coast main road is bordered on both sides by schist and slate formations, traversed by

quartz reefs. These metamorphic rocks are very hard and very siliceous, hence they weather slowly, and their disintegration products give poor soils. The beds are steeply inclined, in many cases on edge. Owing to various strata being of unequal hardness, and the beds dipping at high angles, gullies form along the softer outcrops, and in time grow into steep V-shaped valleys, canyons, and ravines. This country is therefore highly undulating, rough, and hilly, a fact which causes a still further reduction in its agricultural value. The slopes are so steep that no great thickness of soil can form even in the virgin state, when the native timbers, roots, and logs tend to keep back the downward drift of the soil. Clearing such country aggravates the evil, as a single heavy downpour on a cleared slope of this kind might remove every vestige of soil from it. The schist country is therefore practically worthless to the intending farmer. By the expenditure of a vast amount of labour it might be possible to keep back the soil and carry on fruit-growing successfully, but it would not pay at present, since freights, agents' commissions, storage, &c., would swallow up all the returns. Only when the co-operative system is established on a firm basis among fruit-growers will it be worth while to consider how to utilise the South Coast schist slopes. The dominant timber everywhere on the Nelligen schist formation is spotted gum. Zamia forms such a dense undergrowth on it that it might also be classified as "zamia country." Other timbers are wattle, blackbutt, gum, bloodwood, stringybark, with occasional ironbark on the ridges, and oak and box in the gullies. A little cultivation and dairying are practised on the alluvial flats of this area. The greatest extent of the district is, however, of no interest except to the timber-getters and dealers in wattle bark.

F. *Moruya Granite Type.*—South of the schists we have the Moruya granites. This being a vast, massive formation (and not composed, as the former, of beds of unequal hardness), it gives rise to gently undulating country. The soil is therefore deeper than on the schist country, and less leached (where left in the virgin state). The land is of a superior quality, and this fact is borne out by the timbers, which consist of box, apple, gum, and wattle, with occasional ironbarks on the bleaker mountains. Zamia and spotted gum occur only rarely on this formation. Neither is grass-tree abundant. The alluvial flats along the Moruya River are excellent. The granite country itself, of course, gives a comparatively poor soil, which becomes exhausted after a certain period of grazing or cultivation, but which is well drained and sufficiently deep, and therefore fertile while it lasts. On the alluvial, corn, potatoes, and fodder crops are successfully produced, and the granite country is chiefly used for dairying. To the south of Moruya, from Bergalia to Lake Coila, occur patches of volcanic country, consisting of andesite, trachyte, basalt, and perhaps also phonolite, which give rise to very good soils. Interspersed with them are areas of Moruya granite and Nelligen schists, with their characteristic soils. To the north of Moruya, near Mogo, there occurs a patch of sandstone country of the most useless type. It does not appear to be an old formation, but rather a Tertiary drift. As one enters this formation from the schist country, no

remarkable change can be observed in the colour and texture of the soil, but the ruggedness of the topography ceases and the flora changes suddenly from the "spotted gum and zamia" type to the "peppermint, grass-tree type." We have therefore, in this case, a fine instance of how the zamia clings to the sweet but shallow and drought-stricken soils of the rough schist country, and the stunted grass-tree to the equally poor, but deeper, sour, and ill-drained soils of the horizontally bedded sandstones. Behind (or rather to the west of) Mogo there lies an area of fine-grained diorite-granite, which is typically developed on Buckembowra wattle plantation. This formation, as will be noted in the analysis, gives a better soil than the Moruya granite. At Bodalla Estate we reach some fine alluvial flats, surrounded by zamia (or schist) country. A few miles further south there are more granites and hard schists, but near Wagonga the schists take on a different facies, and we will consequently discuss them separately.

G. *The Narira Schist Type.*—These schists occur, with occasional interruptions by granite, diorite, and basalt formations, along the main road, from 7 miles south of Bodalla to Brogo. At Tilba Tilba and Mount Dromedary they are interrupted by diorites, gabbro, and basalt; at Cobargo and Verona by very acid granite and aplite, and at Brogo by quartz diorite. The Narira schists are softer than the Nelligen schists, and therefore give rise to a less rugged topography. The soils are therefore deeper, less leached, and less stony on the Narira type. Still their quality is poor. The scrub or undergrowth is very thick between the forest trees, which consist of spotted gum, mountain ash, apple, box, stringybark, wattle, and hickory. The zamia is very plentiful on the harder country, where the soil is shallow, and the rock near the surface. The appearance of mountain ash, apple, and box in association with spotted gum, is indicative of a better class of country than where spotted gum is unaccompanied by these. Considerable difficulty is experienced in clearing this type of country. If it is ringbarked or felled, and then burnt off, a dense jungle of young trees immediately shoots up and exterminates the grass. This jungle has to be grubbed up season after season for several years before it is possible to utilise the country. Ringbarking is even worse than clearing in this respect, and very much tolerable grazing country has been spoiled both in New South Wales and Queensland by thoughtless owners having ringbarked more land than they were able to keep in condition with axe and hoe. A little forethought and experience will often save the intending settler much needless expense of labour and money.

H. *The Dromedary and Brogo Masses.*—At Tilba, Mount Dromedary, and Brogo there are large areas of diorite, quartz diorite, and gabbro country, which yield excellent soils of considerable depth and of a dark brown to black colour. These soils are extremely fertile, and capable of producing crops for a long term of years without any risk of exhaustion in mineral plant-food. In quality they are as good, if not better than, the Milton soils. The diorite country is partly mountainous, partly undulating. The timbers are typical of good country, box and apple being abundant.

I. *Brogo Canyon Volcanic Type.*—South of the Brogo diorite and quartz diorite formations we enter a rugged yet very fertile canyon area, composed of intermediate volcanic rock.

J. *Bega Granite Type.*—Beyond the Brogo volcanic areas we meet with the Bega granites, which are less siliceous and richer in lime minerals than the normal Moruya granite. This country is gently undulating, and is covered with a fairly deep, though not very rich, soil. Most of this is good dairying country, but in places where the rock is more acidic than usual it is approaching exhaustion. The usual forest timbers are met with.

III.—Special points of interest in connection with the development of the South Coast.

1. *Thickness and size of forest no guide to agricultural value of land.*—It is often thought by inexperienced men that land which grows big timber is of necessity good. This is a mistake that is apt to lead many men to ruin. The South Coast schists, both of the Nelligen and Narira types, are commonly heavily timbered with huge spotted gums, yet for reasons already stated, the country of this formation has little agricultural value. In southern Queensland much extremely poor, hilly, sandstone country is equally heavily timbered with blackbutt, yet it may be useless for agriculture and grazing. To clear such land is sheer waste of money and time. Left in the virgin state, or still better tended by experienced forest rangers, it would always be an asset to the State for the timber it grows; but when cleared the soil for the most part washes away into the creeks and streams, and what is left is so leached as to be useless.

The cause of the spotted gum thriving on the shallow schist soil is probably to be found in the fact that it sends its roots deep into the crevices of the steeply-bedded rocks, and there finds food and water during the hot summer months, when less deeply rooting plants would be scorched to death. The zamia plant is protected from the heat of the summer sun by its own crown of leaves, and finds in the rugged schist country the perfect drainage which it needs.

To attempt to settle people on either the Nelligen schists or Jervis Bay sandstones would be a futile waste of energy, for this country is at present unable to keep any men but the timber-getters. No farmer who occupies a farm of poor or shallow soil, needing heavy manuring and special precautions to prevent soil-creep, can make his land pay when far from the market.

This kind of country is eminently fitted for timber, and should be preserved for timber alone. To settle people on it would involve a national waste of capital and labour, and end in hopeless failure.* In many districts of such a character we see numerous deserted homesteads with soil so poor as to be unfit for rabbits, land on which hundreds of pounds have been expended in clearing and in the erection of fences and

*** The same remarks apply also to parts of the Pilliga Scrub with which the writer is acquainted.**

houses for the bush-fires to destroy; and what is just as bad is that in order to clear this land hundreds of pounds worth of valuable timber (one of the State's best assets), had been cut down and burnt.

2. *The Zamia Problem.*—The zamia, or burrawang, has a bad name down the South Coast, and is blamed for a common cattle disease known in this part of the country as "the rickets." It appears that cattle frequently develop a taste for the zamia, and after eating of it immediately develop a paralysis of the hindquarters, due to a poison in the plant. Consequently, cattle-breeders and dairymen wage war on the burrawang, and grub it out by the roots. In some cases the zamia country is sufficiently good to become tolerable grazing country after much expenditure of time and money on the extermination of the pest; but in most cases this kind of country is so rugged, and has so shallow a soil that the destruction of the native plants can only have the effect of a rapid removal or creep of the soil to the valleys. Clearing will soon leave these schist-beds so bereft of soil that the land will be worse than useless. No grass will grow on the schists, the soil being so shallow that few grass species can withstand the scorching summer heat of the sun.

Thorough scientific research on the zamia has never been carried out. It is, therefore, still possible that it may contain some principle of economic value. If we can find a use for it, there is little doubt that its eradication will be more rapid than desired.

3. *Forest-belts as Wind-breaks and Soil-preservers.*—These remarks apply more particularly to mountainous country. In surveying such land it is often desirable that belts of forest or scrub should be left to shelter the country put under cultivation, and to prevent excessive leaching and the downward creep of the soil which result from the unimpeded wash of the rain-water down steep slopes. Large areas of fine scrub country of the steep south Queensland ranges (parts of the Blackall Range, &c.) have been cleared to such an extent that the soil must soon wash away, leaving only bare rocks. This process can be delayed by leaving buffers of virgin scrubs.

4. *Osteomalacia or the Bone-chewing Habit with Cattle.*—This is a matter which will only be briefly referred to here, as it is under special investigation in the Department of Agriculture at present, and will shortly be fully reported on. On the South Coast osteomalacia is very prevalent in many localities—as at Sassafras, the Moruya district, and parts of the Bega district. It is generally worst where the soils exhibit a marked deficiency in lime, and when one portion of a district is affected and another unaffected, a notable difference usually exists in the lime content of the soils of the two localities. The unaffected areas consist mostly of dark-coloured soils, well supplied with lime, and possessing a porous subsoil. The affected areas have light-coloured, poor soils and clayey subsoil. In connection with this the writer has noticed in various parts of New South Wales and Queensland that the bone-chewing habit is always most prevalent on geological formations like sandstones, granites, and aplites, which yield

siliceous sandy soils poor in lime, and absent on limestone, basalt, dolerite, diorite, and gabbro soils, which are well supplied with lime. The following facts, however, tend to render difficult the solution of the problem of the cause of the complaint:—

(*a*) For a large number of years the Moruya and Bega districts, with their granite soils, were free from the disease, but of late years it has become very prevalent.

(*b*) Some of the affected areas in these districts have better soils than unaffected areas in other districts.

(*c*) The Bergalia andesite soil from an infested paddock is comparatively rich in lime and phosphoric acid.

The surface 4 inches of soil in bone-chewing areas are exceedingly hard, almost like cement, so that a pick must be used to break it up. The subsoil is also rather hard, lumpy, and dry. The causes of these peculiarities are probably, first, the clearing or ringbarking of the country; and secondly, the continued tramping of cattle on the ground.

Clearing or ringbarking has the effect of destroying the life of those large tree roots whose growth causes constant breaking up of the soil and aeration of the subsoil. The humus percentage of the surface soil, which in the natural state keeps it in a loose and aerated condition, is greatly reduced by the absence of decaying leaves and grass, for the trees are now gone, and no longer yield the former, and the grass is eaten by the cattle as fast as it grows. Absence of vegetable matter and constant trampling leads to the surface soil forming a hard crust, which probably is further cemented by salts drawn up from below by capillarity. The absence of vegetable matter hinders the transformation of the lime silicates and zeolites into carbonate, in which form the lime is most beneficial. The hardness of the surface soil prevents water and air from reaching the subsoil, hence that animal life—particularly earth-worms—which should exist in the soil to maintain its fertility, is absent. The lime is therefore not brought up to the surface by these animal agencies. As a result only the coarsest and hardiest grasses will grow. This probably accounts for the spread of Bergalia grass in the southern districts.

It appears, therefore, that this land suffers from a kind of exhaustion brought on by clearing and overstocking, without any effort to maintain the condition of the soil.

5. *Connection between Forests, Floods, and Rainfall.*—Experience shows in the United States that the clearing away of forests exposes the country to disastrous floods. The run-off of the water is very rapid, and the rivers quickly rise. Moreover, the soil is washed off the land quickly, and what is left is impoverished by leaching. Rivers silt up and have to be constantly dredged, and their waters are always turbid where before they were usually crystal clear.

All these effects have been experienced by the people of the Bega district, and are being felt in Queensland by those who live in the vicinity of the

Brisbane River. The reservation of forest belts is clearly the remedy for the evil.

With regard to rainfall, it is a matter of common knowledge in Italy and France that forest devastation has reduced the rainfall in certain areas. The same lesson is gradually being learned in Australia. In the Blackall Range of Southern Queensland the rainfall has palpably diminished since the clearing of the scrubs began, but a more serious effect of clearing is that the rain falls in heavy downpours instead of a prolonged drizzle, the run-off is rapid, the surface soil is wetted and beaten hard, and, as already shown, the impoverishment by leaching is increased.

A forest or scrub area produces, by the constant evaporation from the leaves, a moist atmosphere, and consequently an area of low atmospheric pressure towards which moisture from adjacent regions will be drawn. It is cooler than adjoining regions, owing to the absorption of solar rays by plant life, and therefore less reflection of these rays into the atmosphere. Hence such a region experiences frequent showers. Each shower enhances evaporation and gives rise anew to those conditions of atmospheric pressure which produce further showers.

As an instance, we may take the Pilliga Scrub. This is largely a very sandy area, thickly timbered with pine, and well suited to be a timber reserve. The dense arboreal vegetation ensures to the Pilliga Scrub a much better rainfall than the surrounding plains, and even better than the Warrumbungle Mountains, to the south of it. Conditions are here favourable for the production of small low-pressure areas, which give rise to frequent showers at certain times of the year. If this country were wholly cleared, a different set of conditions altogether would rule. The bare sands would be heated almost to redness in the fierce sun of that region, and the air would become hot, as in a furnace. A constant high-pressure system would lie over the area, and rain would only visit it on exceptional occasions, as, for example, when a Queensland monsoon is driven rather far south. What is now a valuable asset to the country as a timber reserve would, if wholly cleared, degenerate into a desert. Hence closer settlement on any but the most fertile portions of the Pilliga Scrub should be avoided as a national calamity, involving the ruination of the settlers and the loss to the State of the timbers.

IV.—The chemical analyses of type soils of particular geological formation.

(a) Alluvial Soils.—The alluvials which we are chiefly concerned with are sediments brought down by rivers in past times. They consist of gravels, sands, and muds, the last of which eventually become excellent soil. Alluvial soils are frequently very deep, reaching ten, twenty, or even, in some cases, a hundred feet in depth, and in addition they are very well balanced and rich in plant-food. There is therefore no danger of exhausting deep alluvial soil by cultivation, as far as the present generation is concerned.

Table I, page 104, illustrates the chemical composition of alluvial soils on the South Coast.

TABLE I.—Alluvial Soils, South Coast.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
Shoalhaven Flats, about 1 mile N.E. of Nowra on roadside.	Dark grey	Weakly acid.	inches 7 2 Good.	per cent. 40 Fair.	per cent. 71·9 Heavy loam.	per cent. 3·84	per cent. 8·82	per cent. ·294 Good.	per cent. ·355 Satisfactory.	per cent. ·110 Satisfactory.	per cent. ·189 Satisfactory.	Typical river alluvial.
Moruya Flats, about 1 mile S.E. of Moruya.	Dark grey	Acid	6 Good.	33 Low.	24·2 Light loam.	1·32	5-23	·126 Satisfactory.	·173 Satisfactory.	·047 In-different.	·049 In-different.	Alluvial wash from granite country.
Milton, valley 2 miles N. of Milton	Black ..	Acid	10 Excellent.	53 Good.	82·2 Clay.	3·87	10·98	·266 Good.	·263 Satisfactory.	·067 Fair.	·086 Fair.	Alluvial wash from basalt.
Nelligen, 1 mile along Braidwood road.	Dark ...	Very faintly acid.	9 Excellent.	56 Very good	76·3 Clay.	2·07	7·21	·154 Good.	228 Satisfactory.	·110 Satisfactory.	092 Fair.	Wash from slate and schist country.

The four soils given in this table are fair farming soils. The first alone is a typical river alluvial, and is fairly representative of the alluvials of large rivers usually met with. The other three are inserted for comparison, and will be repeated under their proper geological headings.

True alluvial soils occur on the flood plains of various South Coast rivers, *e.g.*, the Shoalhaven, Clyde, Moruya, Tuross, and Bega.

(*b*) *Sandstone Soils*.—Sandstones are sedimentary rocks, consisting mainly of sand grains, which are held together by a cementing material. The composition of the latter is the chief determinant of the quality of the soil obtained.

If the cement be calcareous, the soil will be a fairly fertile and moderately dark coloured loam; but if it consist of ferriferous or aluminous clay, the soil will be exceedingly poor in mineral plant-food. Tuffy sandstones and felspathic sandstones in which lime felspar partly takes the place of quartz grains may also give rise to fair soils.

We may, therefore, divide sandstone soils into two groups—

(I) Those derived from calcareous sandstones, tuffy sandstones, and lime felspar sandstones. With these we may also class the soils derived from shales and mudstones of similar composition.

(II) Those derived from siliceous sandstones, with alumina or iron hydrate as cementing material; also siliceous shales. The first group is well represented along the South Coast railway, from Clifton to Nowra, while the second covers the whole country from Nowra to Sassafras, Jervis Bay, and Ulladulla. The Hawkesbury sandstones, between Stanwell Park and Sydney, and the Kiama Tertiary Sandstone also belong to the second group.

The composition of these soils is given in tables IIA and IIB.

(*c*) *Granite Soils*.—Granite is a coarse-grained crystalline rock consisting of quartz, felspar, mica, and hornblende. Owing to the different rate of expansion of its constituent minerals on subjection to heat or cold and the different hardness and solubility of these minerals, it readily crumbles under the action of weathering, and forms soils. Fine-grained, compact rocks like basalt, or rocks composed almost wholly of the same mineral, like siliceous sandstone, respond less rapidly to weathering agencies.

Granitic rocks yield sandy loams, and loams varying in colour from light grey to dark brown, and also varying in mineral food ingredients in accordance with the amount of lime-bearing felspar and hornblende in the rock. Thus *acid* granites low in lime minerals yield poor soils; *basic* granites fairly well supplied with lime minerals yield good soils. The typical Moruya granite is a coarsely crystalline rock consisting of quartz, orthoclase (potash felspar), biotite (black mica), and minor ingredients, including a little hornblende, apatite, plagioclase (soda-lime felspar), and magnetite. Owing to its poverty in lime minerals the soil is rather poor and easily exhausted.

TABLE IIA.—Good Sandstone Soils.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remark
			inches.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	
Near Lewis' vineyard, Mount Keira, Wollongong.	Dark grey	Strongly acid.	5½ Good.	36 Fair.	94·7 Clay.	5 00	13 23	. . .	·162 Satisfactory	·132 Satisfactory.	·119 Satisfactory.	Shaly sandstone of tuffy origin; hill.
Near Lewis' vineyard, Mount Keira.	Dark grey	Very strongly acid.	6 Good.	45 Good.	62·4 Heavy loam.	5·21	6 01	·182 Good.	·205 Satisfactory.	·058 Fair.	·127 Satisfactory.	As above, but small gully.
Mount Keira slopes	Light brownish	Acid	5 Good.	48 Good.	79·7 Clay.	5·38	14·43	·322 Good.	·582 Good.	·213 Good.	232 Good.	Tuffy sandstones on mountain slope.
Near Mount Kembla	Light grey.	Acid .	8½ Very good.	50 Good.	51·0 Loam.	2·02	6 05	·126 Satisfactory.	·305 Satisfactory.	·093 Fair.	·132 Satisfactory.	Mudstone on slopes.
Unanderra Flats, near Wollongong.	Dark grey	Acid ..	6½ Good.	39 Fair.	85·2 Clay.	3·95	11·53	·112 Satisfactory.	·510 Good.	·140 Satisfactory.	·216 Good.	Shaly sandstone flats.

Osteomalacia absent on these soils.

TABLE IIB.—Poor Sandstone Soils.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
			inches.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent	per cent.	
Sassafras, 5 miles N.N.W. of Bainbrigge's.	Grey ..	Very strongly acid.	4·1 Fair.	12 Very low.	28 6 Light loam.	5·11	4·40	·098 Fair.	·010 Very bad.	·050 Fair.	029 Bad.	Typical of Sassafras Banjera Swamps; Upper Marine; Nowra grits.
Near Jervis Bay–Nowra road ..	Yellow ..	Faintly acid.	7·5 Very good.	36 Fair.	28·1 Light loam.	1·30	2 52	·028 Deficient.	·062 Indifferent.	·018 Bad.	·035 Indifferent.	Same geological series as Sassafras; typical of large area.
Turpentine Range Homestead ..	Grey .	Strongly acid.	4 Fair.	39 Fair.	52·8 Good.	3·70	6·42	·147 Satisfactory.	·075 Indifferent.	·057 Fair.	036 Indifferent.	Shaly sandstone.
Jervis Bay road, 2½ miles from Nowra.	Grey ..	Strongly acid.	7 3 Very good.	32 Low.	55·3 High.	2 24	4 97	·042 Deficient	·048 Bad.	·026 Bad.	·035 Indifferent.	Shaly Sandstone.

Osteomalacia very prevalent on these soils.

The Buckembowra granite is a more basic type, containing less quartz and rather more plagioclase than the Moruya granite. It weathers more readily and gives a better, as well as deeper, soil of a darker colour.

The typical Bega granite is richer in lime felspar and in hornblende than the average Moruya granite, and consequently yields better soils.

The composition of various soils of the Bega district has been given in a previous article.

The soils of the following areas belong to the acid granite type:—

1. Moruya.
2. Bergalia, Nogooroola.
3. Bodalla.
4. Cobargo, Verona.
5. Parts of the Bega district.

The following are of the basic granite type:—

1. Buckembowra.
2. Parts of Bega district.
3. Brogo.

Table III (page 108) brings out these facts: (1) That the granite soils in the gullies, with only slight fall, and on the flats, to which the country slopes gently, are very similar to the type soils of the surrounding ridges; (2) that where the country is composed of steep hills, as at Cobargo, the soils on the hill-crests are better than the gullies and flats composed of wash, the heavy flow of water having leached the latter soils more considerably than the former.

(*d*) *Diorite Soils.*—Diorite is a quartz-free rock, consisting mainly of plagioclase felspar and hornblende, or augite. With these some orthoclase, apatite, quartz, olivine, magnetite, or titaniferous iron, may be present. The South Coast diorites are mostly augite-diorites. At Milton we have an orthoclase-bearing variety of augite-diorite. The type which yielded the soils analysed from this locality is very similar petrologically to specimens 4913 and 4935, described by Mr. Card in "Records Geol. Surv. of N.S.W." 1905, Vol. VIII. The analysis of this rock was made by Mr. Harold P. White, and shows silica 51·11 per cent., lime 6·51 per cent., potash 3·25 per cent., and phosphoric acid 0·65 per cent. (*id. loc.*).

At Tilba Tilba a number of varieties of rock allied to augite-diorite occur. Some are quartz and hornblende bearing; others contain olivine. All contain more or less orthoclase. Several varieties belong to the group of rocks called *essexite;* some might be termed quartz-gabbro. However, they are all chemically allied to augite-diorite, and yield similar soils. The border rock of this great intrusive mass is a typical dolerite.

At Brogo (McLeod's Hill) we have a great mass of quartz diorite, passing in places into olivine gabbro. This rock, too, is augite-bearing, and yields soil similar to that of Tilba Tilba.

The diorite soils are dark in colour, varying from red or chocolate on some of the hills to black on the gentle slopes and in the valleys. They are very fine-grained and easily worked. The parent rock disintegrates readily,

TABLE III.—Composition of Virgin surface soils; Granite country; South Coast.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
			inches.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	
Nogooroola, hill near Moruya ..	Grey ..	Strongly acid.	6 Good.	32 Low.	42·7 loam.	1·56	5·75	·224 Good.	·164 Satisfactory.	·059 Fair.	·033 Indifferent.	Moruya granite; surface of soil very hard; Paddock affected with bone-chewing, clayey sub-soil.
Flat near Moruya	Dark grey.	Acid ..	6 Good.	33 Low.	24·2 Light loam.	1·32	5·23	·126 Satisfactory.	·173 Satisfactory.	·047 Indifferent.	·049 Indifferent.	Wash from Moruya granite country; soil loose; bone-chewing not prevalent; subsoil sandy.
Buckembowra wattle plantation, West fall.	Brownish	Acid ..	6 Good.	42 Fair	12·0 Sandy loam.	2·29	8·75	·252 Good.	·536 Good.	·462 Very good.	·096 Fair.	Basic granite; no bone-chewing.
Buckembowra, East fall	Brownish	Acid ..	5 Good.	36 Fair.	27·3 Sandy loam.	2·35	9·35	. . .	·541 Good	·321 Good.	·130 Satisfactory.	As the preceeding.
Cobargo, hill-crest	Dark grey.	Faintly acid.	8 Very good.	43 Fair.	30·9 Loam.	2·85	9·47	·196 Good.	·361 Satisfactory.	·107 Satisfactory.	·042 Indifferent.	Acid granites and aplites; subsoil stony; bone-chewing not prevalent.
Cobargo, small steep gully ..	Dark grey.	Acid ..	9 Excellent.	35 Fair.	24·8 Light loam.	1·47	5·26	·112 Satisfactory.	·180 Satisfactory.	·097 Fair.	·023 Bad.	As the previous.
Cobargo, flat wash from hill ..	Light grey.	Strongly acid.	7 Very good.	35 Fair.	40·6 Loam.	1·45	4·14	·083 Fair.	·060 Indifferent.	·097 Fair.	·035 Indifferent.	Sandy wash from same hill as previous.
Verona, hill-crest	Light yellowish.	Strongly acid.	6 Good.	28 Very low.	29·1 Light loam.	2·32	5·67	·098 Fair.	·226 Satisfactory.	·056 Fair.	·040 Indifferent.	Acid granite; aplite and quartzite; cases of bone-chewing occur; subsoil clayey.
Verona, gully with gentle slope..	Dark ..	Strongly acid.	7½ Very good.	36 Fair.	24·9 Light loam.	3·10	7·52	·156 Good.	·066 Fair.	·069 Fair.	·047 Indifferent.	As the hill-crest variety.

TABLE IVA.—Diorite Soils of the South Coast—Virgin soils 1 foot deep.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
Hilltop, 1 mile N. of Milton ..	Dark reddish.	Acid ..	inches. 7 Good.	per cent. 47 Good.	per cent. 44·0 Loam.	per cent. 5·05	per cent. 12 81	per cent. ·305 Good.	per cent. ·382 Satisfactory.	per cent. ·090 Fair.	per cent. ·078 Fair.	Subsoil stoney.
Lower Slopes, 1½ mile N. of Milton.	Black ..	Acid ..	6 Good.	49 Good.	77·1 Clay.	4·77	12·35	·322 Good.	·358 Satisfactory.	052 Fair.	·113 Satisfactory.	Subsoil like surface soil.
Valley, 1¾ mile N. of Milton ..	Dark grey.	Faintly acid.	....	.. .	....	2·88	8 79	·217 Good.	·339 Satisfactory.	·045 Indifferent.	·125 Satisfactory.	This is a wash from diorite hills. Subsoil like surface soil.
Tilba Tilba, lower slopes	Brownish black.	Neutral..	8 Very good.	49 Good.	64·0 Heavy loam.	4·06	11·52	·280 Good.	·916 Good.	·099 Fair.	·379 Good.	. .....
Brogo (McLeod's Hill) crest of hill	Dark brown.	Acid ..	7 Good.	41½ Fair.	49·5 Loam.	3·35	12·55	·252 Good.	·930 Good.	·185 Satisfactory.	·128 Satisfactory.	.... .

TABLE IVB.—Some Andesite Soils—Virgin, 1 foot deep.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
Bergalia, hill-crest	Black ..	Strongly acid.	inches. 4½ Fair.	per cent. 30 Low.	per cent. 86 6 Clay.	per cent. 10·49	per cent. 13·94	per cent. ·336 Good.	per cent. ·392 Satisfactory.	per cent. ·088 Fair.	per cent. ·090 Fair.	Coarse-grained andesite and trachyte. Bone-chewing occurs. Surface very compact, like cement. Subsoil yellow clay.
Unanderra, near Wollongong, hill-crest.	Dark grey.	Strongly acid.	8 Very good.	48 Good.	65·3 Heavy loam.	3·47	8 66	·196 Good.	·070 Indifferent.	·074 Fair.	·077 Fair.	Very fine-grained rock, slow to disintegrate, hence food material leaches out as rapidly as supplied by weathering.

because of its coarse granularity, and all the constituent minerals are easily attacked chemically, so that their chemical constituents are readily made available for plant-food. Hence deep and excellent soils are formed, which might be described as heavy loams and clays. The subsoils are similar to the surface soil (see Table IVA).

The following areas might be mentioned as having soils of this character:—

(1) Milton.
(2) Tilba Tilba, Central Tilba, and Mount Dromedary.
(3) Green Hills, between Tilba and Cobargo.
(4) McLeod's Hill, Brogo, south of Cobargo.

In all these localities the cattle are fat and healthy; the bone-chewing habit does not occur. The land is fertile, and will produce every kind of crop the climate is suited for. Lucerne is successfully cultivated.

Andesite being the volcanic equivalent of diorite, a couple of typical andesite soils were analysed. They illustrate the fact that a fine-grained, compact, even-grained rock decomposes more slowly than a coarse and uneven-grained rock, and consequently the soil is more leached (see Table IVB).

(*e*) *Basalt Soils.*—A coarse-grained basalt (dolerite) decomposes more readily than a fine-grained one; hence it yields deeper and better soils. Basalt is a volcanic rock, consisting of plagioclase, augite, olivine, and magnetite, with apatite and secondary minerals present in variable proportion.

Basalts generally yield good soils, both for farming and dairying purposes. Well-drained basalt soils, as on hill-slopes and tablelands (*e.g.*, Kiama, Sassafras), yield good potato and orchard lands. Fodder crops (oats, lucerne, &c.), grow well on basaltic flats.

On hill-tops basalt gives red or chocolate loams, and in valleys black clayey loams.

Basaltic areas of some considerable extent are found on the South Coast at Kiama, the Jamberoo Range, Cambewarra Range, Sassafras, Milton, and smaller outcrops at Jervis Bay, Tomerong, &c. Great portions of the Monaro are decked with basalt flows.

The Sassafras basalt is a sodalite-bearing orthoclase basalt. The Kiama basalts have been described by Card, and the soils are assigned to the particular rock types identified by him.*

The Milton, Jervis Bay, and Tomerong basalts have also been described by the same author, and my specimens have been found to agree with his descriptions. Chemical analyses of these rocks were made by the Mines Department analysts, and are given in the papers referred to in the foot-note.

The subsoils in basalt country are generally a little more clayey and stony than the surface, and by degrees one passes into a bed of spheroidal pebbles and boulders of decomposing rock.

* Records Geol. Surv. of N.S.W., Vol. VIII, Part 1, 1905.

TABLE V.—South Coast Basalt Soils—1 foot deep.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
			inches.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	
Kiama—Kiama-Jamberoo Tufts	Dark brown.	Acid ..	7 Good.	56 High.	75·7 Clay.	5·30	12·85	·238 Good.	·394 Satisfactory.	·157 Satisfactory.	·137 Satisfactory	Kiama Tuffs—hill-side variety.
Kiama—Bumbo Basalt	Chocolate	Acid ..	6 Good.	35 Fair.	68·0 Heavy loam.	8·30	24·65	·651 Very good.	·662 Good.	·234 Satisfactory.	·674 Very good.	Bumbo Basalt—hill-side variety.
Kiama—Blowhole Basalt .. .	Black ..	Acid ..	9 Excellent.	56 High.	69·7 Heavy loam.	5·69	19·06	·462 Very good	·256 Satisfactory.	·159 Satisfactory.	·163 Satisfactory.	Kiama Basalt. Blowhole type—on hill-side.
Valley, 2 miles N. of Milton .	Black ..	Acid ..	10 Excellent.	53 Good.	82·2 Clay.	3·87	10·98	·266 Good.	·268 Satisfactory.	067 Fair.	·096 Fair	Sp. 5,107, Geol. Rec., 1905, Vol. VIII. Good lucerne and general farming.
Hill-top, 2½ miles N. of Milton ..	Black ..	Acid ..	10 Excellent.	47 Good.	71·3 Heavy loam.	4·65	10·98	·280 Good.	·296 Satisfactory.	·073 Fair.	·161 Satisfactory.	As above.
Sassafras, *via* Nowra (Fainbrigge's).	Red ..	Strongly acid.	12 Excellent.	44 Fair.	57·8 Loam.	7·00	8·96	·126 Satisfactory.	·088 Fair.	·037 Indifferent.	·091 Fair.	Sodalite Basalt. Country leached—still excellent potato country.

The soils are generally deep and enduring, and need little manuring, though superphosphate is often of benefit. In some exposed situations these soils are somewhat leached, and hence poorer in plant food than usual. That is the case with the one from Sassafras.

Phyllite, Schist, and Slate Soils.—Metamorphic rocks, in various stages of metamorphosis, form the dominant geological series from the vicinity of Ulladulla to the neighbourhood of Bega. In chemical composition the majority of the metamorphic rocks would be nearly alike, as they are all highly siliceous types, though a few thin beds of more basic varieties outcrop in places. These rocks are inclined at high angles, and yield rather poor soils. Where metamorphosis is most marked and silicification greatest, they weather so very slowly that, as before stated, the soil is shallow as well as poor.

When these rocks take on the form of shaly phyllites, as between Mount Dromedary and Cobargo, the soil formed is rather deeper. In both cases the soils produced are loams. The vegetation, consisting largely of spotted gum and zamia, has already been remarked on.

The chief industries carried on in this country are timber-getting, saw-milling, and wattle-bark cutting.

Farming or dairying on this kind of land would be difficult to commence, and lead to speedy exhaustion of the soil, with need for heavy manuring, except in the gullies and on the flats.

Table VI gives the composition of some schist or slate soils, and shows that the small gullies in this kind of country have, on the whole, a better soil than the ridges, which is different from what obtains on other formations. The reason of this is probably that the slates and schists disintegrate with the formation of a soil consisting of clay and flat stones. The stones roll into the gullies, where they detain all kinds of detritus, so that the soil between the stones becomes rather good in character.

Table VII (page 114) gives analyses of some typical lucerne soils of the South Coast.

TABLE VI.—Phyllite, Schist, and Slate Soils.—Zamia Country.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
Nelligen, phyllite ridges	Light grey.	Strongly acid.	inches. 5 Good.	per cent. 31 Low.	per cent. 39·3 Loam.	per cent. 2·17	per cent. 8·13	per cent. ·203 Good.	per cent. ·092 Fair.	per cent. ·104 Satisfactory.	per cent. ·040 Indifferent.	Very shallow soil, and stony.
Nelligen, small gully in same phyllites.	Dark brownish.	Strongly acid.	8 Very good.	50 Good.	52·3 Loam.	3·07	9·78 ...	·280 Good.	·160 Satisfactory.	·161 Satisfactory.	·046 Indifferent.	Very stony soil.
Nelligen, slate on ridges	Yellow.	Strongly acid.	6 Good.	33 Low.	33·3 Loam.	1·61	5·84	·143 Satisfactory.	·083 Fair.	·180 Satisfactory.	·040 Indifferent.	Very shallow and stony.
Nelligen, slate in small gullies ..	Dark.	Acid.	10 Excellent.	46 Good.	65·3 Heavy loam.	4·67	13·57	·238 Good.	·318 Satisfactory.	·165 Satisfactory.	·110 Satisfactory.	
Alluvial flat from slate; schist and phyllite country.	Dark.	Very faintly acid.	9 Excellent.	56 Very good.	76·3 Clay.	2·07	7·21	·154 Good.	·228 Satisfactory.	·110 Satisfactory.	·092 Fair.	Good general farming land

TABLE VII.—Lucerne Soils, South Coast.

Locality.	Colour.	Reaction.	Capillary Power.	Water Capacity.	Clay.	Moisture	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
Shoalhaven Flats	Dark grey	Faintly acid.	Inches. 7·2 Very good.	Per cent. 40 Fair.	Per cent 71·9 Heavy loam.	Per cent. 3 84	Per cent. 8·82	Per cent. ·204 Good.	Per cent ·355 Satisfactory.	Per cent. ·110 Satisfactory.	Per cent. ·189 Satisfactory.	Alluvial.
Kiama	Chocolate	Acid ..	6 Good.	35 Fair.	68 Heavy loam.	8·30	24 65	·651 Very good.	·662 Good.	·234 Good.	·674 Very good.	Bumbo basalt.
Valley, 2 miles N. of Milton ..	Black ..	Acid ..	10 Excellent.	53 Good.	82 2 Clay.	3·87	10 93	·266 Good.	·268 Satisfactory.	·067 Fair.	·086 Fair.	Basalt
Valley, 1½ mile N. of Milton ..	Black ..	Faintly acid	....	....	....	2·88	8·79	·217 Good.	·339 Satisfactory	·045 Sufficient	·125 Satisfactory.	Diorite.
Brogo	Dark brown.	Acid ..	7 Good.	41½ Fair.	49·5 Loam.	3·35	12·55	·252 Good.	·930 Good.	·135 Satisfactory.	·123 Satisfactory.	Diorite.
Tilba	Black .	Neutral..	8 Very good.	49 Good.	64·0 Heavy loam.	4·03	11·52	·280 Good.	916 Good.	·099 Fair.	·379 Good.	Diorite.

Analyses of some Grasses and Fodder Plants grown in New South Wales.

A. A. RAMSAY, Chemist's Branch.

THE results of the analyses of some grasses, sorghums, millets, and rice are given below.

The work was undertaken with a view of having recorded the composition of such grasses and plants grown in New South Wales and generally used by farmers and graziers, and of supplementing our knowledge of their fodder values.

The grasses and fodder plants were grown at the Experiment Farms in various districts, and the analyses were made in the Departmental Laboratory.

The following method was adopted in this examination.

On arrival at the laboratory, an average sample of the fodder was cut up and the moisture and total nitrogen determined. The remainder of the sample was air-dried, and the following determinations made on the air dried sample, the results being afterwards calculated to the moisture-content of the sample as it arrived:—

1. Ether extract.—Six hours extraction with anhydrous ether, the ether distilled off, and the residue dried and weighed.
2. Alcohol extract.—Six hours extraction with 96 per cent. alcohol, the alcohol distilled off, and the residue dried and weighed.
3. Lecithin.—The dried residues of 1 and 2 were taken up with anhydrous ether and the solution evaporated to dryness. The resulting residue was fused with a mixture of sodium and potassium carbonate. The melt was dissolved in water, and the phosphoric acid determined by magnesia mixture

$$Mg_2P_2O_7 \times 7{\cdot}2703 = \text{Lecithin.}$$

The method is that given in Wiley's Principles and Practice of Agricultural Analysis, vol. III, page 430.

The other determinations were made according to the methods of the official agricultural chemists of America, the insoluble albuminoids being the nitrogen in the crude fibre × 6·25; the total albuminoids is the same from the total albuminoid nitrogen × 6·25. The amides were determined by multiplying the amide nitrogen (obtained by distillation with magnesia) by 4·714, and entered as asparagin.

The results are set forth in the accompanying tables. The difference between the sum of the determinations made and 100 is returned as "Nitrogen free extract," and includes starch, sugar, gums, &c.*

Albuminoid Ratio.—This represents the ratio of albuminoids to carbohydrates, and has been calculated as (soluble + insoluble albuminoids + amides) ÷ (fat × $2\frac{1}{4}$ + digestible fibre + "nitrogen free extract" + lecithin).

Nutritive Value.—This figure is the sum of the nutrient matters in the fodder, the fat being multiplied by $2\frac{1}{4}$ to give its equivalent of carbohydrate. It expresses the potential energy of the food, and is based on the finding of Atwater† that the average energy in a gram of protein, fat (ether extract), and carbo hydrates respectively = 4·1, 9·3, and 4·1 calories.

All the *Paspalum* grasses seem high in cellulose and woody fibre.

Phalaris is richer in soluble albuminoids and amides, though poorer in insoluble albuminoids than the *paspalum*; the cellulose, also, is less in the *Phalaris*.

The two samples of Rhodes grass are quite dissimilar; this may, probably, be explained by the different ages of the grass.

Sheep's Burnet.—This is particularly rich in fat, being nearly twice as much as any of the other grasses. The proteids also are high, and the cellulose low, while the carbo-hydrate portion contains nearly as much of starch and sugar as of digestible fibre.

The amount of nutritive matter it contains is only very slightly exceeded by Rib grass (*Panicum prolutum*), and is higher than in any of the other grasses.

Texas Blue Grass.—This grass contained a very high percentage of soluble proteid matter, three times as much as the mean of all grasses. Of the carbohydrates, a large proportion exists as digestible fibre, and a very small proportion as soluble nitrogen free extract. The fodder analysis shows it to be about the same as *Paspalum* or Guinea grass.

Comparison of these Grasses with Analyses made in America, Germany, and Queensland.

On comparing the average composition of grasses of New South Wales with American, German, and Queensland grasses, it is striking that the ash content of Queensland grasses is very nearly double that of any other grasses in the table.

* The results tabulated have all been calculated to "dry substance." If they are to be calculated to any required moisture content, all that is necessary is to multiply this figure by

$$\frac{100 - \text{percentage of water.}}{100}$$

For example, in the first sample given, the ether extract calculated to dry substance is 1·21.

If the original contained 75 per cent. water, this figure would become

$$1{\cdot}21 \times \frac{100 - 75}{100} = 0{\cdot}30 \text{ per cent.}$$

† W. O. Atwater.—Third Annual Report Storr's School Agric. Ex. Stn., 1890 (also *Century Magazine*, July, 1887).

TABULATED Analyses of Grasses, &c., calculated to Dry Substance.

DIVISION I—(Grasses).

Name of Grass.	Locality.	Ether Extract.	Albuminoids.		Digestible Fibre.	Woody Fibre.	Ash.		Amides as Asparagin.	Lecithin.	Nitrogen free Extract.	Albuminoid Ratio. Total N × 6·25.	Nutritive value.	Food Units.
			Soluble.	Insoluble.			Soluble.	Insoluble.						
Paspalum dilatatum ...	Berry ...	1·21	·66	5·58	41·49	33·42	4·17	2·12	1·00	1·49	8·86	1 : 7·2	62·1	73·8
Do ...	Wollongbar ...	1·48	·90	6·22	38·40	37·12	3·85	3·45	1·06	1·91	5·61	1 : 5·9	57·8	70·9
Do ...	Richmond ...	1·65	·84	7·42	40·15	36·70	3·10	1·21	1·13	2·19	5·61	1 : 5·3	61·4	76·5
Paspalum virgatum ...	Wollongbar ...	1·52	·85	6·03	43·19	36·74	3·42	2·14	1·08	2·01	3·02	1 : 6·2	60·0	72·8
Phalaris commutata ...	Glen Innes ...	2·78	·96	5·12	45·30	27·67	4·30	3·88	1·58	·92	7·49	1 : 7·3	68·1	81·1
Do ...	Wagga ...	2·90	1·25	4·49	40·00	29·48	5·48	3·81	1·88	1·38	9·33	1 : 7·0	65·5	78·5
Rhodes grass ...	Richmond ...	2·34	·28	8·63	22·58	23·77	1·10	6·11	2·11	2·27	30·81	1 : 5·2	72·6	90·8
Do ...	Wollongbar ...	1·84	·84	6·23	40·26	30·20	4·64	2·51	1·09	2·37	10·02	1 : 6·7	65·3	78·5
Sheep's Burnet ...	Glen Innes ...	5·02	1·00	8·42	28·81	22·52	4·24	4·54	1·30	2·62	21·53	1 : 5·8	75·4	93·4
Italian rye ...	,, ...	2·17	·18	5·83	41·71	27·50	2·65	4·49	2·37	·96	12·14	1 : 6·5	68·8	83·1
Perennial rye ...	,, ...	2·11	·23	6·16	44·50	25·18	2·28	4·70	1·06	2·42	11·36	1 : 8·1	70·8	83·0
Rib ...	,, ..	1·90	·36	10·94	42·32	17·03	6·63	3·01	1·57	2·38	13·86	1 : 4·7	76·2	96·7
Texas Blue ...	Wagga ...	1·94	2·27	5·76	39·44	33·77	3·28	4·15	1·33	2·18	5·88	1 : 5·3	61·7	77·0
Guinea ...	Wollongbar ...	1·00	·15	6·84	38·31	33·61	·42	4·35	3·08	1·00	11·24	1 : 4·8	63·9	80·7
Panicum prolutum ...	Wagga ...	2·44	1·17	4·68	40·47	25·36	3·11	3·64	1·61	1·47	16·05	1 : 8·0	71·5	82·6
Schedonorus Hookerianus ..	Glen Innes ...	2·01	·47	4·23	42·13	32·70	3·46	2·77	2·03	2·37	7·83	1 : 7·7	64·3	75·9
Cocksfoot ...	,, ...	2·47	·94	5·54	38·70	30·91	3·11	3·99	1·99	2·82	9·53	1 : 6·2	65·7	80·0
Danthonia penicillata ...	Wagga ...	2·04	·89	4·43	44·09	28·78	1·53	8·87	1·03	2·33	6·01	1 : 8·5	63·7	74·2
Wheat hay ...	,, ...	1·87	2·11	4·20	31·81	25·20	1·02	5·18	·84	2·20	25·57	1 : 8·6	71·2	82·8
Straw—Skinless barley ...	,, ...	1·18	1·03	2·09	37·91	36·79	1·88	3·73	1·00	2·52	11·87	1 : 12·7	59·3	66·4
Straw—Zealand wheat ...	,, ...	2·07	·08	2·59	35·70	37·92	·88	5·91	·93	2·28	11·64	1 : 13·9	58·2	64·6

TABULATED Analyses of Grasses, &c., calculated to Dry Substance—*continued.*

DIVISION II—(Millets).

Name of Grass.	Locality.	Ether Extract.	Albuminoids. Soluble.	Albuminoids. In-soluble.	Diges-tible Fibre.	Woody Fibre.	Ash. Soluble.	Ash. In-soluble.	Amides as Aspara-gin.	Lecithin.	Nitro-gen free Extract.	Albu-minoid Ratio. Total N × 6·25.	Nutri-tive Value.	Food Units.
Millet — China Hsiao-mi, white.	Wollongbar ...	2·11	·71	7·37	49·19	23·33	1·05	2·87	·69	·60	12·08	1 : 7·4	75·6	89·6
Millet — China Hsiao-mi, Yellow.	„ .	2·74	1·25	8·85	43·62	27·44	·74	2·53	2·34	·80	9·69	1 : 4·6	73·5	93 9
Teosinte	„ ...	1·39	1·46	5·81	42·55	27·67	4·27	2·76	1·98	·91	11·20	1 : 5·9	67·7	82·8
DIVISION III—(Rice).														
Rice—dry land paddy ...	Wollongbar ...	2·00	·67	14·00	35·74	24·67	3·77	5·13	4·31	2 00	7·71	1 : 2·5	70·3	101·4
DIVISION IV—(Sorghums).														
Sorghum—Planter's Friend...	Wollongbar . .	2·66	2·09	5·07	36·27	15·27	1·43	1·30	1·57	·73	33·61	1 : 8·3	85·8	100·3
Do —*Andropogon*, No. 3.	„ ..	2·67	3·04	5·85	52·51	16·48	2·54	1·89	2·30	1·78	10·94	1 : 6·0	83·2	101·7
Do —*Andropogon*, No. 9.	„ ...	1·83	2·16	4·11	37·33	23·46	3·03	1·69	1·63	1·84	22·89	1 : 7·9	74·6	87·7
Do —Black line Kaffir corn.	„ ...	2·13	·5	4·21	37·18	26·55	2·97	1·89	2·27	1·85	20·42	1 : 8·2	72·0	84·1
DIVISION V—(Clover).														
Ball clover	Wagga ...	0·82	1·28	12·34	35·18	32·20	1·49	4·78	1·68	2·45	7·78	1 : 3·0	63·1	87·1

The fat in the New South Wales grass is slightly lower than in the American or German, but greater than Queensland grasses.

The nitrogen-free extract approximates to that of the American, and is slightly more than is in the German or Queensland grasses.

In crude fibre New South Wales grass is a little higher than the American, and higher also than the Queensland.

In albuminoids, the New South Wales grasses are similar to American, but very much lower than German or Queensland grasses.

The nutritive value shows New South Wales grasses to be slightly inferior to American grasses.

TABLE showing the average composition of New South Wales Grasses, and comparison with American, German, and Queensland Grasses.

	Number of Analyses.	Ash.	Fat.	Nitrogen Free Extract	Crude Fibre.	Albuminoids.
American*—						
United States	135	7·97	3·14	53·97	25 71	9·21
North of Potomac	70	7·64	3·44	55·01	23·70	10·21
South	27	8·80	2·74	52·55	26 68	9 23
Middle west	8	7·12	2·96	54·58	25 39	9·95
West of Mississippi ...	30	8·23	2·86	52 67	29·60	6·64
German (Wolff), from the Bulletin quoted below—						
Fair	......	6·30	2·34	46·53	34·09	10 74
Good	......	7·23	2·92	47·84	30 69	11·32
Very good	......	8·24	3·29	48·93	25·77	13·77
Queensland (by Mr. J. C. Brünnich)	9	12·42	1·93	49·73	22·53	13·39
New South Wales—						
Excluding the two straws..	19	6·67	2·14	52·81	29·35	9·03

* From Agric. Grasses and Forage Plants of the United States. Dept. Agric. U. S. A. Botanical Division. Special Bulletin, 1889, p. 130, &c.

The following table shows the limits of the composition of the grasses examined (excluding the two samples of straw):—

	Highest.	Lowest.	Mean of all Grasses.
Ether extract	5·02	1·00	2·14
Soluble albuminoids	2·27	0·15	·86
Insoluble albuminoids	10 94	4·20	6·15
Digestible fibre	45·3	22 58	39·14
Woody fibre	37·12	17·03	29·35
Soluble ash	6·63	0·42	3·25
Insoluble ash	8·87	1·21	3 95
Amides	3·08	·84	1·53
Lecithin	2 82	·96	1·96
Nitrogen free extract	30 80	3·02	11·67

Or condensed to render them comparable with other analyses :—

	19 N.S.W. Analyses.		136 American Analyses.[3]		8 Queensland.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Ash	10·40	4·31	19·24	3·57	13·89	7·08
Fat	5·02	1·00	5·77	1·48	2·84	1·09
Nitrogen free extract ...	58·06	45·58	66·01	34·01	56·93	40·08
Crude fibre	37·12	17·03	37·72	17·68	35·34	11·95
Albuminoids	13·37	6·68	23·13	2·80	19·34	6·56

[3] *Loc. cit.*

On comparing the limits of composition of grasses—viz., highest and lowest—it is seen that the variations are greater in every case than the American grasses, and approximate more to the Queensland limits.

As to the nitrogen content of these grasses, they approximate to the American grasses, but are much lower in nitrogen than similar Queensland grasses given. The table also shows that though the amount of nitrogen is greatest in the Queensland grasses, there is a larger percentage of the nitrogen existing as proteid matter in the New South Wales grasses, and a lower percentage of nitrogen as non-proteid, than is the case with either American or Queensland grasses.

The distribution of the nitrogenous matter and the nitrogen in these groups is as set forth, though it is not intended to imply that these same proportions will always obtain.

	Grasses.	Millets—Teosinte.	Rice.	Sorghum.	Clover.	Mean of all.
Soluble albuminoids ...	0·83	1·14	0·67	1·96	1·28	1·02
Insoluble albuminoids ..	5·78	7·34	14·00	4·81	12·34	6·30
Amides	1·48	1·67	4·31	1·94	1·68	1·66
Soluble albuminoid nitrogen	9·57	10·60	3·28	20·93	8·09	10·73
Insoluble albuminoid ,,	66·60	68·25	68·69	51·50	77·87	66·15
Amide nitrogen	23·83	21·15	28·03	27·57	14·04	23·12
Total	100·00	100·00	100·00	100·00	100·00	100·00

COMPARISON of Nitrogen contents of New South Wales, American, and Queensland Grasses.

	New South Wales.		American.		Queensland.	
	Amount of Nitrogen in dry matter.	In Percentage of total Nitrogen.	Amount of Nitrogen in dry matter.	In Percentage of total Nitrogen.	Amount of Nitrogen in dry matter.	In Percentage of total Nitrogen.
Amide nitrogen	·31	22·63	·43	29·74	·70	30·59
Proteid nitrogen	1·06	77·37	1·02	70·26	1·58	69·41
Total nitrogen ...	1·37	100·00	1·45	100·00	2·28	100·00

It will be seen that in order of content of nitrogenous bodies the groups stand thus :—

(1) Rice, (2) Clover, (3) Millets—Teosinte, (4) Sorghums, (5) Grasses.

Lecithin.

It was thought that while engaged on this work the determination of lecithin might be made, to ascertain if there was any very great variation in lecithin content, and also owing to the scarcity of recorded data concerning this substance.

Lecithin is a nitrogenous body, allied both to the fats and proteids, and appears to be a compound of cholin with glycerolphosphoric acid. Its formula is $C_{42}H_{86}NPO_9$. Lecithin is widely distributed in animal and vegetable organisms, and from a physiological point of view is highly important as the medium for the passage of phosphorus from the organic to the inorganic state and the reverse.*

The results, however, show that this figure does not help much towards determining the value of the fodder, since the lecithin content of members of a group vary more than the various groups do, as will be seen from a comparison of the subjoined table with the analyses.

Distribution of Lecithin in the various groups.

	Grasses.	Millets—Teosinte.	Rice.	Sorghum.	Clover.	Mean of all.
Lecithin (in dry matter) ...	1·86	1 67	2·00	1·62	2·45	1·84

For purposes of comparison, a table is given showing the lecithin content of certain foods.

Distribution of Phosphorus in certain Foods.—W. Heubner and M. Reeb. (Chem. Zentralbl., 1908, 2, 1948), reprinted in Analyst, 1908, XXXIV—103 (March).

	Dry substance.	∴ Water.	Total Phosphorus.	Phosphorus as Lecithin.	$=Mg_2P_2O_7$	=Lecithin % in dry matter.
Horseflesh	26·0	74·0	·74	0·15	·54	3·89
Cow's milk	12·6	87·4	·84	·05	·18	1·30
White of egg	12·6	87·4	·12	......	......	......
Bread	70·1	29·9	·14	·01	·04	0·29
Rice	87·8	12·2	·11	·005	·02	0·14
Bran	98 8	1·2	1·47	·02	·07	0·50
Carrots	13·6	86·4	0·40	·03	·11	·79
Beetroot	14·6	85·4	·19	·04	·14	1·01
Green Cabbage	12·3	87·7	·48	·07	·25	1·80
White Cabbage	8·3	91·7	·31	·06	·22	1·59

* Wiley, Principles and Practice of Agric. Analysis, Vol. III, 430.

Amides.—Under this heading are included those nitrogenous bodies in the plant allied to albuminoids, but which are non proteid in their nature, and are sometimes termed "non-proteids," which is short for "non-proteid albuminoid bodies." These are chiefly organic bases, amides, amido acids, and similar bodies existing in the plant as intermediate stages in the synthesis of proteids, and as their subsequent cleavage on the metabolism of the plant. It seems probable that the functions of amides (since they are soluble in water) is the transference of organised nitrogen from one part of the plant to another in the process of growth.

Asparagin is one of the principal amides found in plants, and for that reason the amido-nitrogen (column 8) found was multiplied by 4·714, though some workers use the figures 6·25.* Up to the present asparagin has not been found to be capable of being transformed into proteids in the animal body, and this may probably be true of the other amides.† But though the amides cannot serve as a source of proteids to the animal, it seems that they may by their oxidation perform a part of the functions of proteids, thus protecting part of the proteid from oxidation and rendering that portion available for tissue production.

Weiske concluded that asparagin was capable of partially performing the function of proteids, and thus acting indirectly as a source of proteids, and this view is generally accepted.

Zuntz has suggested that amides may be used in the digestive canal of herbivora as nitrogenous food for the micro-organisms there present in preference to the less soluble proteids, thus protecting the attack on the proteids, and suggests, further, that it is even possible amides may be synthesised to proteids by these organisms.

This explanation seems to be correct, and is supported by the results of Weiske, Chomsky, and Killner, who find the effect of asparagin to be more marked when the proportion of proteids in the food is small.

The amides then may be considered as nutrients, and we have therefore added them to the albuminoids in calculating our albuminoid ratio.

As the figure 6·25 is sometimes used to find the amides from the amido-nitrogen, and as in ordinary fodder analyses the proteids are obtained by multiplying the total N by 6·25, the three columns giving albuminoid ratio, nutritive value, and food units, have been calculated on this assumption, and are, therefore, comparable with all other analyses issued as regards "albuminoid ratio" and "nutritive value."

Food Units.

A few years ago Smetham‡ put forward a scheme of valuing fodders based on what he termed "food units," and this has the support of Dr. Bernard Dyer.§

* Armsby—Principles of Animal Nutrition, 1903, page 8.

† Armsby—Principles of Animal Nutrition, 1903, page 53; compare Politis Zeit f. Biol, 28, 492.

‡ Smetham—Royal Lancashire Agric. Soc. Jour., 1904.

§ Dyer—"Fertilisers and Feeding Stuffs," 1908.

It ought to be clearly understood, however, that this scheme does not purport to give the actual potential feeding value, but is rather the value of the fodder from food value plus value of manure obtained, and the term chosen to express this, though probably the best available, is yet somewhat of a misnomer. Smetham contends that proteid matter is worth $1\frac{1}{4}$ times as much as carbohydrate for food value, and $1\frac{1}{4}$ times as much for manurial value, or a total of $2\frac{1}{2}$ times the carbohydrates. Further, that fat has a heat-producing power = $2\frac{1}{2}$ times greater than carbohydrates (starch 2·4 times and grape sugar a little more than 2·5 times). This chemist adds together the sum of the albuminoids and fat, multiplies this by $2\frac{1}{2}$, and adds this result to the carbohydrates to find the "food units."

This method of valuing fodders would prove more valuable to the farmer who wishes to feed stock, and also conserve the manure for use; but to do this presupposes that the stock are bedded, and that the fæces, and particularly the urine, are conserved, conditions which do not always obtain in farms in this country.

The grasses examined have been set out from lowest to highest in both schemes of "Nutritive Value" and "Food Units," and with one or two exceptions keep their respective positions in both schemes.

Lowest value. Highest value.

Nutritive Value	No. 20	26	25	21	1	23	30	17	22	3	28	19	7	4	5	8	24	2	6	9	29
Food Units..............	26	25	20	21	30	22	3	1	23	28	19	17	7	4	5	24	8	29	2	6	9

The valuation of the nutrients, fat, protein, and carbohydrate in fodders has been attempted but without success. In America analyses of all the concentrated feed stuffs were made, and the market price obtained. Then by calculation the supposed values of each of the nutrients were obtained, the results being:—

For protein, the value in cents per lb. varied from 0·91 to 2·02
,, fat (ether extract) ,, ,, ,, -0·19 to 5·91
,, carbohydrates 0·47 to 1·40

From the above figures it will be seen how impossible it is to get a mean of these figures, and that any computations made on such figures would be inaccurate and without merit. Henry says*: "At present it is impossible to state the value of one feeding stuff in terms of another from calculations based upon the nutrients contained in each."

* Henry: "Feeds and Feeding," 1902, p. 118.

Bare Patches: Their Causes and Treatment.

LIONEL COHEN, Chemist's Branch.

Sterility not always due to lack of Plant-food.

Of the various difficulties that beset the agriculturist in many parts of the State, not the least is that of bare or unproductive patches of soil, which, as a rule, remain so in spite of all efforts at manuring and cultivation. It is therefore a question of great economic importance to ascertain the specific cause of this unproductiveness, with a view to applying a remedy, since, without this knowledge, all treatment must be of an empirical nature, and consequently slow and costly.

The investigation, from a chemical point of view, has in many cases been rendered very complex, on account of the fact that the bare patches are, as a rule, as well supplied with plant-food as the fertile soils adjoining, and even better supplied than some other soils known to produce payable crops.

It may first be necessary to explain that the mineral plant-food in the soil exists in at least three forms: firstly, that already in solution in the soil-moisture; secondly, the portion rendered available to the plant by the decomposition of the rock-particles, and soluble in acids; thirdly, the portion contained in the undecomposed rock-particles, which only become available very slowly, as the result of weathering, cultivation, &c. Since, therefore, on examination, in certain cases the bare patches are found to contain not only sufficient reserve material, but ample dissolved and available plant-food to suffice for the needs of any crop, and also in the majority of cases the mechanical condition is all that could be desired, there is abundant evidence that in these lack of suitable plant-food cannot be the cause of the sterility. In this paper it is my intention to deal at length only with four special cases of unproductiveness, which were found to be due to none of the usual causes.

Various Causes of Sterility.

In dealing with the problem of infertility, then, it becomes necessary to seek some substance in the soil which may have a deleterious effect on the growth of the plant, or, as it is called, some toxic property.

Several toxic substances are known to be the cause of desert tracts in the arid regions of America, and also of Australia, such as carbonate of soda, sulphate of soda, and common salt; but the occurrence of these presents no difficulty of diagnosis, and their effects are being successfully counteracted by systems of drainage, judicious irrigation and cropping.

Amongst the less frequent causes are the presence of ferrous compounds (lower oxides of iron), sulphides from pyrites, and excess of magnesia over lime. In the United States a number of soils exist, both virgin and cultivated, which are being at the present time examined for some toxic principle of organic origin, to which alone some American investigators consider their

unproductiveness due. Several bodies have been up till now isolated, but prove for the most part to be quite without injurious effect on wheat seedlings.*

Bare Patches due to Manganese.

In examining for heavy metals a sample of soil from bare patches which had broken out during last winter on Dubbo bowling-green, the writer found a considerable quantity of manganese, while only the merest trace existed in the rest of the green. As regards plant-food, the soil on which the grass died was slightly richer than the healthy soil. Notes on this case by Mr. F. B. Guthrie have already been published in the *Journal of the Royal Society of New South Wales.*

This bare patch contained:—

Manganese in Dubbo Soil, as Mn_3O_4.

	Per cent.	lb. per acre, 6 in. deep.
Total	0·245	3,675
Soluble in HCl	0·021	315
Soluble in 1 per cent. citric	0·032	480

Following on this, we received the *Journal of Industrial and Chemical Engineering* of the American Chemical Society† containing a paper by W. P. Kelley, of the Hawaiian Experiment Station, in which the author came to the conclusion that excessive quantities of manganese were the cause of the failure of certain soil in Hawaii to grow pineapples. He pointed out, however, that sugar-cane grew luxuriantly in the same soil. As may be seen from the Note on the Occurrence of Manganese‡ already published, certain characteristics in common with the behaviour of the Dubbo soil and the Hawaii soil point to manganese as the cause of the death of couch grass on the former.

Similar results to these were later obtained with soil of dioritic origin from a bare patch at Milton, in the South Coast district, on which the owner had tried unsuccessfully to grow barley, though it produced fair crops of oats, sorghum, and maize. The analyses of the good and bad portions are as follow:—

Soil from Milton, South Coast District.

	Good Soil.	Bad Soil.
Reaction	Faintly acid	Acid
Moisture	2·88 per cent.	4·94 per cent.
Volatile and organic matter	8·79 ,,	11·65 ,,
Nitrogen	·217 ,,	·224 ,,
Lime	·339 ,,	·405 ,,
Potash	·045 ,,	·041 ,,
Magnesia	·224 ,,	·174 ,,
Phosphoric acid	·125 ,,	·142 ,,
Manganese, citric soluble	·034 ,,	·062 ,,
Manganese, soluble, HCl ...	·038 ,,	·087 ,,

* Schreiner and Schorey, "Agrosterol," J. Am. Chem. Soc., Vol. 31, Jan., 1909.
† Vol. 1, No. 8, August, 1909.
‡ J. Roy. Soc., N.S.W., Vol. 43, 1909, "Note on Occurrence of Manganese," F. B. Guthrie and L. Cohen.

Thus the bare patch contains twice as much manganese as the normal soil that produced good crops of barley.

Barley particularly sensitive to Manganese.

With reference to the failure of barley, we find in the Annual Report of the Chemical Society, 1906, vol. 3, that T. Katayama, at Tokyo, in experimenting on the alleged stimulating effect of manganese on crops, found that ·015 per cent. of manganous sulphate in the soil increased the yield of peas 50 per cent. in the straw and 25 per cent. in the peas; whereas with barley the total increase was only 10 per cent. Quantities much exceeding ·015 per cent. tended to decrease the yield. G. Salomone* confirms these results as to the beneficial influence of small quantities of manganese and the toxic action of large amounts, and points out that manganic salts are more toxic than manganous. Apparently the limit of tolerance of the barley plant for the compound of manganese soluble in hydrochloric and citric acids lies somewhere between ·04 and ·06 per cent.

Manganese in Bare Patch at Bathurst Farm.

Samples of productive and unproductive granite soil from Bathurst Experiment Farm were next examined for manganese, and the results strongly supported the theory that this substance in some forms was a plant poison. Scattered through the bad sample were fragments of a soft black mineral somewhat resembling wad, which was found to contain a high proportion of manganese, while the percentages of the latter in the soils themselves were:—

Good soil	...	...	·026 per cent. Mn_3O_4.
Bad soil...	...	...	·114 „ „

Toxic to Certain Crops only.

According to Hilgard ("The Soil"), Johnson ("How Crops Grow"), and others, the variation in quantity of manganese present in the ashes of different farm crops, trees, and grasses, is extremely wide. In some cases none at all, or the merest undeterminable traces have been found, while in isolated instances, such as in one analysis of leaves of the red beech, as much as 11 per cent. and more may be present; it has even been known to exceed the amount of iron in the ash. But these high percentages must be considered accidental, because numerous other samples of the same varieties have been proved free from all but traces.†

It is evident, therefore, that the toxic properties of manganese vary with the kind of crop, some, such as sugar-cane, being able to flourish in the presence of large quantities; consequently, where certain crops have failed on a particular area through the occurrence of this substance, other crops known to be tolerant of larger quantities should be tried.

* Chem. Centr., 1906, ii, 532. † Johnson, "How Crops Grow," p. 194.

The large proportion of the total manganese in a soil that is soluble in 1 per cent. citric acid is significant. In the Milton bare patch nearly as much is soluble in citric as in hydrochloric acid, and in the Dubbo soil half as much again.

With the mineral plant-foods potash and phosphoric acid, however, only from one-tenth to one-third of the HCl soluble is soluble in 1 per cent. citric acid, showing that a very much larger proportion of manganese than potash or phosphoric acid is in a condition ready to be absorbed into the tissues of the plant.

This will be seen better from the following figures:—

Dubbo Bare Patch, soluble in 1 per cent. citric.

Oxide of manganese .	·032 per cent.
Potash	·011 ,,
Phosphoric acid	·017 ,,

It is quite probable, nevertheless, that some soils may contain larger quantities than these of more insoluble compounds of manganese, and yet grow good crops for years, until by the action of organic acids secreted by the plant or produced by the decomposition of vegetable débris, enough is rendered soluble to be harmful. In connection with this, an observation of Hilgard,* in comparing the soils of arid and humid regions, is specially interesting. He says that, although the arid soils are much higher in lime, potash, and phosphoric acid (he refers to the amounts soluble in hydrochloric acid), the proportion of manganese is greater in the humid soils in the ratio of 13 to 11.

The facts noted above seem to fully account for this; the manganese being so remarkably soluble in dilute organic acids that the prolonged action in the humid soils of the humus acids on the "reserve" manganese (silicates or insoluble oxides) has resulted in the formation of compounds easily soluble in hydrochloric acid.

Bare Patches at Coolabah due to Calcium Chloride.

The bare patches at Coolabah Experiment Farm were the next to be examined, and samples were analysed of the first and second 3 inches of soil, both good and bad, from two different sites. They were marked as follow:—

A, from site 1, top 3 inches—good soil.
B, from site 1, second 3 inches—good soil.
C, from site 1, top 3 inches—bad soil.
D, from site 1, second 3 inches—bad soil.
F, from site 2, top 3 inches—good soil.
G, from site 2, second 3 inches—good soil.
H, from site 2, top 3 inches—bad soil.
J, from site 2, second 3 inches—bad soil.

* "The Soil," p. 283.

Below is analysis of the first 6 inches of the good and bad soils, made some years ago:—

	Good Soil.	Bad Soil.
Reaction	Acid.	Strongly acid.
Moisture	1·61 per cent.	1·16 per cent.
Volatile and organic matter	4·15 ,,	4·88 ,,
Nitrogen	·056 ,,	·066 ,,
Lime	·080 ,,	·079 ,,
Potash	·150 ,,	·126 ,,
Phosphoric acid	·054 ,,	·058 ,,

The quantities of plant-food soluble in hydrochloric acid are approximately the same in all these soils. Moreover, they are alike in colour and mechanical condition (red loam). The amounts of manganese in each are mere traces, too small to have any effect on the fertility of the soils; they were therefore examined as to their content of water-soluble salts.

On shaking the soils with distilled water, it was noticed that the bad ones settled out fairly rapidly, leaving a clear solution above; whereas the good ones left an appreciable amount of finely-divided clay in suspension, indicating a larger soluble-salt content in the bare patch.

A, B, F, and G were found to have the same characteristics, in that they all possess a normal amount of water-soluble salts. On the other hand, C, D, H, and J gave very much higher figures. Taking A as typical of the good, and C of the bad soil, the figures are:—

A ... ... ·025 per cent. water-soluble.
C ... ... ·090 ,, ,,

or a ratio of about 1 : 3½.

The moisture-content of the top soil under normal conditions is about 4 per cent.; consequently the concentration (percentage of salts in solution) of the soil-moisture is :—

$$\text{A} \quad \ldots \quad \ldots \quad \frac{\cdot025 \times 100}{4} = \cdot625 \text{ per cent.}$$

$$\text{C} \quad \ldots \quad \ldots \quad \frac{\cdot090 \times 100}{4} = 2\cdot250 \quad ,,$$

The latter quantity is excessive, and would have a deleterious effect on the growth of many crops.

The residue on the evaporation of the aqueous extract of C deliquesced on exposure to air, but that of A did not; also there was no effervescence on addition of acid to either, showing that only very small quantities of carbonates are present. This fact suggesting calcium chloride, the solutions were tested, and the four bad samples showed a remarkably large excess of both calcium and chlorine compared with the good samples.

It has been shown by Professor Jamieson* that in certain cases potassium chloride acts as a plant-poison, and his experiments were afterwards confirmed by Dr. J. M. H. Munro.† In connection with this, Aikman‡

* Chem. News, Vol. 52, p. 287. † *Ibid*, Vol. 53, p. 2. ‡ "Manures and Manuring."

points out that sulphate of potash is preferable to choride of potash as a manure, since the latter is apt to give rise to calcium chloride, "a compound distinctly harmful to many plants."

It is also noted that the bad soils are more acid in reaction than the normal ones. This, in conjunction with the large excess of calcium chloride, seems to throw some light on the unproductiveness, when certain conclusions of Kühn (Johnson, "How Crops Grow," p. 184) are applied thereto.

He has shown that "when ammonium chloride is employed to supply maize with nitrogen, its ammonia is assimilated, and its chlorine, which the plant cannot use, accumulates in the solution in the form of hydrochloric acid to such an extent as to prove fatal to the plant."

Again, at the Woburn Experimental Farm, England, the "continued use of ammonium salts (sulphate and chloride) on a soil originally containing very little lime has brought about an acid condition of the soil and complete sterility. On the application of lime, the acidity was neutralised, and fertility at once restored."*

This does not necessarily imply that the acid condition of the soil before liming is due to free mineral acid, since the latter, when liberated, would soon decompose the less stable organic compounds of the alkalies and alkaline earths, and combine with the bases, setting free the humus acids.

Now, as all these (Coolabah) soils contain only small quantities of calcium, and that to a large extent (in the bad ones) as chloride, it is possible that the wheat, in order to obtain sufficient lime, is obliged to split up the calcium chloride, and there being not sufficient calcium carbonate to neutralise the resulting acid in the immediate vicinity of the root-hairs, the acid remains in the free state, and injures the organism.

It is difficult to reconcile with this theory the failure of lime as an antidote, unless it be that in one season sufficient lime was not dissolved to produce the necessary effect, and that a longer time or a more intimate mixture with the soil may be required.

It is stated that superphosphate has a beneficial effect on the bad patches at Coolabah Farm. As the soil is not alkaline, the calcium in the calcium chloride would not be precipitated by the monocalcium phosphate in the fertiliser. I am therefore inclined to think that the moisture conditions, due to increased rainfall last season, may have caused the apparent improvement, since the amount of calcium chloride necessary to affect the crop increases with the amount of water present in the soil.

When determining the moisture at different depths in the Coolabah soils last year in connection with the tillage experiment, two distinct varieties of subsoil in the third foot were noticed, one friable and porous, the other of a rather stiff and impervious nature.

It is possible that the accumulation of the injurious salt in certain parts has been due to insufficient drainage, caused by the presence of some of these impervious patches of subsoil.

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* Ann. Report Chem. Soc., Vol. 2, 1906, p. 254.

Summary and Conclusions.

1. Three cases of bare patches at widely-separated localities, viz., Bathurst Experiment Farm, Milton, and Dubbo, have been found, in which the sterility is concomitant with a considerable excess of manganese over the surrounding normal soil.
2. As some farm crops appear to tolerate comparatively large amounts of this substance, the simplest method of utilising the bare patches would be to cultivate such crops only on them.
3. The bare patches at Coolabah Experiment Farm are apparently due to the presence of calcium chloride, caused probably by an impervious subsoil, which exists in places at a depth of 2 or 3 feet.
4. This substance, being extremely soluble, would be removed from the top soil if the drainage were thoroughly efficient in these patches.
5. The sterility of the Coolabah bare patches may also be partly caused by the decomposition of the calcium chloride by the plant in its search for lime, giving rise to hydrochloric acid.
6. That being the case, thorough and liberal dressings of lime should restore fertility by inducing a more neutral condition, and rendering unnecessary the assimilation of the calcium in the calcium chloride by the growing crop.

A New Fodder Plant.

SENATOR the Hon. J. H. McColl has drawn the attention of the Department of Agriculture to *Scævola collaris*, F.v.M. (Natural Order *Goodeniaceæ*), a comparatively rare plant, only found in South Australia, on sand ridges near the coast and in the interior. Senator McColl states that it has afforded fodder for sheep for some months, and that they did well on it. The South Australian Department of Agriculture have been asked for a small packet of seed for trial.

Closer Settlement.

WITH our readers, we welcome the private subdivision of large estates of agricultural land in addition to the beneficial results of the action of the Government under the Closer Settlement Act. Attention is invited to an advertisement in this issue of the proposed sale of the Ariah Estate, between Temora and Barellan, on Wednesday, 23rd February. The estate comprises 18,700 acres, and has been subdivided into thirty farms. The joint auctioneers are the Pastoral and Finance Association, Limited, 13, Phillip-street, Sydney, and Messrs. Gelling and Sons, Temora.

A new subdivision of the Gloucester Estate is also advertised, close to Gloucester township, on the North Coast Railway. The vendors are the Gloucester Estate, Limited, 45, Hunter-street, Sydney, and Mr. J. A. McKenzie, of Gloucester, is agent.

Holstein-Friesian Cattle.

R. H. ALEXANDER, Manager, Wollongbar Experiment Farm.

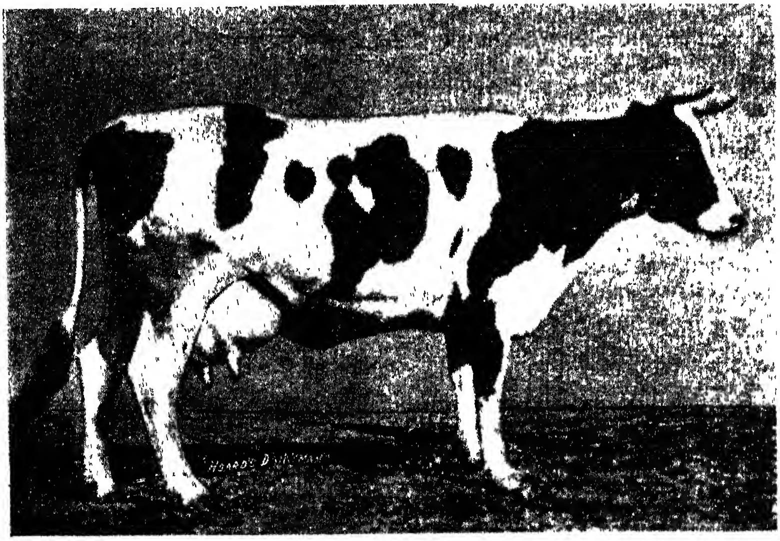
LITTLE is known regarding the origin of the Holstein-Friesian cattle. We know that for hundreds of years Friesians have been the dairy stock of Holland, a country famed since the ninth century for the high quality of its dairy produce.

In the Netherlands and Prussia various strains of Friesian cattle exist, such branches being named after the province or locality in which they are bred. Familiar names are East Friesian, Holstein, West Friesian, and Oldenburgers. Importations to Australia have been confined principally to Friesians and Holsteins, which being practically the same, are treated as one breed, and classed as Holstein-Friesians. For generations conditions in Holland have been such that dairymen in that country could not afford to keep bad or even medium cows. Land being expensive, must be stocked with paying cattle, and worked to the full to make ends meet. Room being limited, only a small percentage of calves born can be reared annually. One authority states not more than 20 per cent. are reared for breeding purposes. The vigorous system of culling adopted, with heavy milk production always the objective, has made the Holstein-Friesian cattle what they are to-day, the heaviest milking of all dairy breeds.

Unfortunately, quantity of milk was, until recent years, the only result bred and culled for by the breeders of Holland, but these breeders are now, with the aid of Herd-testing Associations, gradually working towards an increase in the average butter-fat contents of the milk of their cows. That they will succeed cannot be doubted, as Australian records of Holsteins have demonstrated that while certain families yield a milk extremely low in butter fat, other strains of the breed are really good testers. . . . .

Holsteins are the largest of all the dairy breeds. The average live weight of Holstein cows may be placed at 1,100 lb. Being heavy and large of frame, Holsteins are best suited to country easy of access, and where feed is fairly abundant. Where long distances have to be travelled from bails to paddocks, or where rough hills have to be negotiated, or the milkers have to roam over scanty pastures in search of food, Holsteins will not show to advantage, though in this country Holsteins have proved their ability to stand a fair amount of exercise and privation, more than some writers give them credit for.

For the city or suburban dairymen Holstein cows, either pure or high-grade, should prove excellent. No animal will respond more freely in milk yield to liberal feeding than the Holstein.



From *Hoard's Dairyman.*

Fig. 1.—Grace Fayne.

Owned by H. A. Moyer, New York. 6 years 23 days of age; butter 7 days, 35·55; average fat 5·42. Her 30-day record of 1909 is not yet available.

At 5 years	19 days	of age—butter	7 days,	30·55;	average fat,	4·37.
,, 5 ,,	19 ,,	,, ,,	,, 30 ,,	126·68	,, ,,	4·01.
,, 4 ,,	13 ,,	,, ,,	,, 7 ,,	29·16	,, ,,	4·12.
,, 4 ,,	13 ,,	,, ,,	,, 30 ,,	119·22	,, ,,	4·09.

This is the world's 7-day record for a Holstein-Friesian cow. She was the world's record 4-year-old of 1906 and 1907. It will be noticed that she has an average better than 4 per cent. fat during the past three years in all her records.

Grace Fayne's record demonstrates what can be done by heavy and judicious breeding, combined with care and attention.

The weak point of the Holstein is the somewhat low percentage of butter fat in their milk. Local averages credit them with 3·45 per cent. butter fat. While the average is certainly low, it must be remembered that the Holstein is, as a rule, a heavy and persistent milker, and taking a lactation period, Holsteins, as actual butter producers, are found to compare favourably with the recognised butter breeds.

Holstein milk is better for cheese or milk condensing than for butter-making purposes, and as a food, is recommended for young children in preference to milk carrying a high percentage of butter fat.

An objection raised to Holsteins is that they need heavy and liberal feeding. In this respect they stand about equal to Shorthorns, only that when dry they do not fatten so readily as do Shorthorn cattle. When in milk, no matter what breed the cow, the heavier the milker the more fodder will she consume, and surely if a cow correspondingly responds in milk yield to quantity and quality of food given she is worth feeding up to her best.

Holsteins are a healthy, good constitutioned breed, carry good udders, good teats, are free, easy, and most persistent milkers. Holstein calves are more easily reared as poddies than calves of any of the other dairy breeds. At birth they are strong and vigorous, taking to the bucket as readily as they would to the dam's teat.

The man not overburdened with money, who has to be satisfied with breeding milk into his herd, and has a somewhat nondescript lot of stock, of rather mixed breeding and not very satisfactory as milkers, should get a Holstein bull; for this bull's progeny get another Holstein bull. No breed of bull will more quickly put milking quality into the progeny of mongrel cattle than will the Holstein. The stock produced will be mostly black and white, though yellow and white cattle often result, especially when the cows used show Shorthorn breeding. After the second cross of Holstein blood, local conditions will have to determine the next step. If the country is suitable, the best method to follow would be, breed on to the Holstein, making the herd a Holstein one. On the other hand, conditions may not be of a kind to suit a high-grade Holstein herd; in this case an infusion of Ayrshire blood (say) in every third generation of Holstein may be all that would be needed, to restrict the size of frame in the individual cow, and to make the herd generally more active and better foragers; or the breeder may have country suitable for Holsteins, but may wish to increase the percentage of butter fat in his herd's milk yield. A change to either Jersey or Guernsey sires should have the desired effect. Crosses as mentioned, with Ayrshire and Jersey, have proved in New South Wales very satisfactory, the Jersey cross being a remarkably good one. When the progeny of the Guernsey-Holstein cross come into work they should be thorough dairy cows. This cross is now being tried on the Bodalla Estate, two Guernsey bulls having been imported for the purpose in November, 1907, and now are being mated to heavy milking yellow and white Holstein and Holstein grade cattle. Results should be looked forward to with considerable interest.

On the Bodalla Estate Holsteins have been bred for the past twenty years. The Home Farm herd, of over 100 pure and almost pure Holsteins, is a picture that would appeal to any cattle man. For milking appearance and actual paying results, considering the number of cows, the herd at Home Farm will be difficult to beat in the Southern Hemisphere.

So highly is this breed favoured on Bodalla that three farms, milking nearly 400 cows, have been devoted to pure or high grade Holstein stock.

In America, the Holstein is held in very high esteem. As dairying advances in Australia, and the merits of this excellent breed becomes more widely known, the Holstein-Friesian cattle will be much more popular in this country than they are at present.

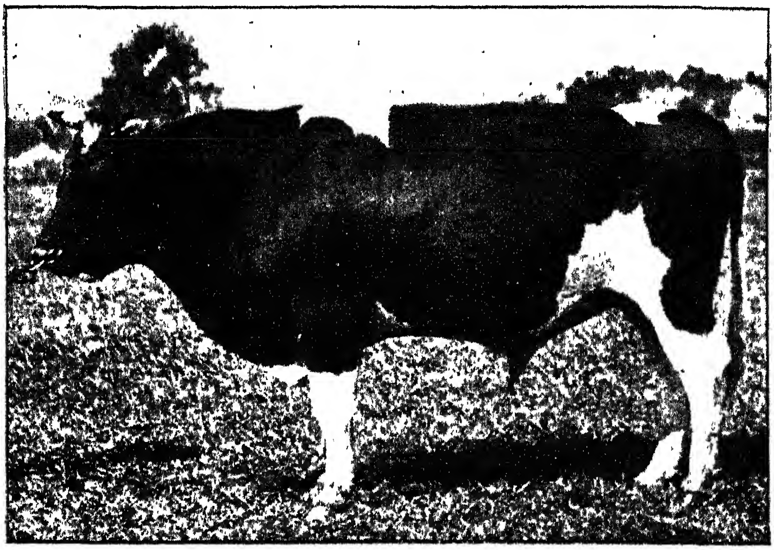


Fig. 2.—Holstein Bull Obbe II. Bred at Berry Stud Farm.

Judging points of Holstein cattle as drawn up by the Holstein-Friesian Association of America:—

BULLS.

	Points.
Head—Showing full vigour, elegant in contour	2
Forehead—Broad between the eyes, dishing	2
Face—Contour graceful especially under the eye, medium in length, broad muzzle	2
Ear—Of medium size, fine, covered with soft hair	1
Eyes—Moderately large, full and bright	2
Horns—Medium in size, fine in texture, short, oval, inclining forwards ...	2
Neck—Neatly joined to head and shoulders, nearly free from dewlap, of good length, proud in bearing	5
Shoulders—Of medium height, well-rounded, and even over tops	4
Chest—Low, deep, and full	8
Crops—Full, and level with shoulders	4
Chine—Straight, broadly developed, and open	3
Barrel—Well-rounded, with large abdomen	6
Loins and Hips—Broad, full, long, and level	5
Rump—High, long, broad, and level	5
Thurl—High and with great width	4
Quarters—Long, straight behind, wide and full at sides	5
Flanks—Deep and full	2
Legs—Short, clean, tapering, with strong arm; in position firm, wide apart; feet of medium size, round, solid, and deep	6
Tail—Reaching to hocks or below, large at setting, tapering finely to a full switch	2
Hair and handling—Fine, soft, and mellow; skin of moderate thickness, and of a rich yellow colour; secretions oily	10
Mammary veins—Long, large, branched, with extensions entering large orifices	10
Rudimentary teats—Not less than four, large, and well spread	2
Escutcheon—Large, and fine development	3
Scrotum—Of good size, well-hung, even-sized testes	5
Perfection...	100

Fig. 3.—Holstein Cow Boswe. Bred at Wollongbar Experiment Farm.

Cows.

	Points.
Head—Decidedly feminine in appearance, comparatively long from eyes to base of horns; fine in contour	2
Forehead—Dishing, broad between the eyes	2
Face—Contour fine, especially under the eyes, showing facial veins; medium length, broad muzzle	2
Ears—Of medium size, fine, covered with soft hair	1
Eyes—Moderately full, large and mild	2
Horns—Set moderately narrow at base, fine, oval, well bent, inclining forward	2
Neck—Fine, nearly free from dewlap, neatly joined to head and shoulders, top line slightly curving, of good length, moderately thin; elegant in bearing	4
Shoulders—Fine and even over tops, lower than hips, deep and broad	3
Chest—Low, deep, and broad	6
Crops—Full, and level with shoulders	2
Chine—Straight, broadly developed, and open	3
Barrel—Well-rounded, with large abdomen	5
Loins and hips—Broad, full, long, and level	5
Rump—High, long, broad, level, with roomy pelvis	4
Thurl—High, with great width	4
Quarters—Long, straight behind, roomy in the twist, wide and full at sides	4
Flanks—Fairly deep and full	2
Legs—Short, clean, tapering, with strong arm; in position firm, wide apart; feet of medium size, round, solid, and deep	5
Tail—Reaching to hocks or below, large at setting, tapering finely to a full switch	2
Hair and handling—Fine, soft, mellow; skin of moderate thickness, of a rich yellow colour; secretions, oily	10
Mammary veins—Large, long, crooked, branched, with extensions entering large orifices	10
Udder—Capacious, flexible, well-developed both in front and rear; teats well-formed, wide apart, and of convenient size	12
Escutcheon—Large, and fine development	8
Perfection	100

In colour markings Holsteins should be distinctly black and white, though yellow and white is not unknown. Each colour must stand out distinct. There should be no intermingling of the black with white, or white with black. The best-marked animals usually show white from hock and knees downwards; also on switch and lower half of tail; tail head and pin bones being almost always black.

Fig. 4.—Holstein cow and calf.

This picture of a Holstein cow and her calf shows an ideal pair of animals, perfectly colour-marked, and in every way true to type. In the cow, note the rather long face, also space between eyes, and from eyes to base of horns, and compare with judging points. The horns are also what is asked for in Holsteins in colour. They should be of a creamy white, running to dark at the tips. The cow shown is correct as to body and length of leg. The bull, being a youngster, appears more leggy; but his head, neck, and body lines show splendid type and quality. His tail seems well set on, but looks, if anything, short for his size.

Viewed side on, Holstein cows do not show the true wedge-shape usually found in the dairy animal. They appear as in the cow in above picture inclined to be straight on the underline.

Standing behind, and looking over back to shoulders, Holsteins show the wedge-shape of heavy milkers, are wide across the hook and pin bones, giving plenty of room underneath for a wide udder connection, and allowing ample room between the legs for the udder.

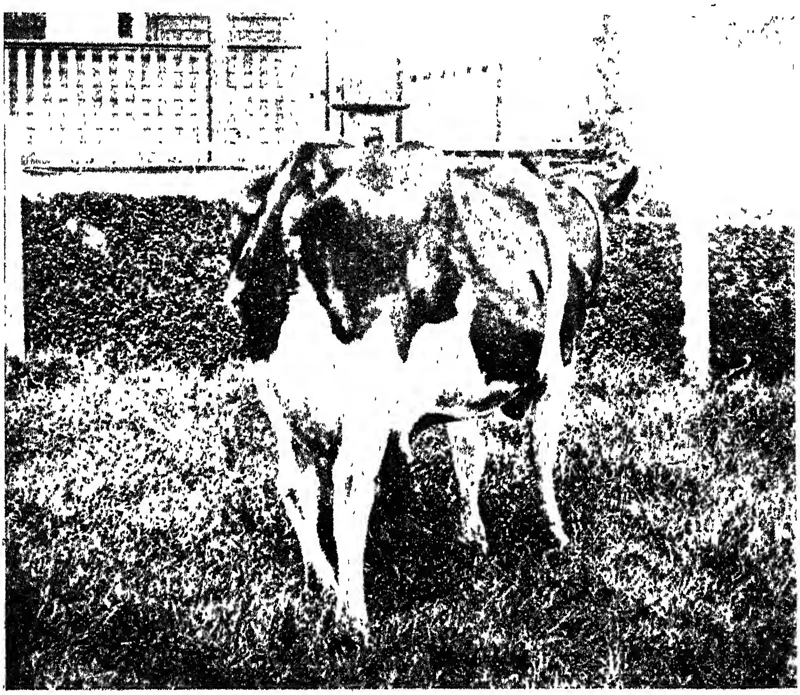


Fig. 5.—Holstein Cow Boswe, born 13th March, 1903.

Showing the desired prominence and width at hook and pin bones, also an excellent udder development.

Boswe's Grass-fed Milk and Butter Record.

Period.	Boswe—Date of Calving.	Lactation period in days.	Yield of milk in pounds.	Total yield of Butter-fat. lb.
1	26 November, 1905	317	9,073	333·36
2	11 December, 1906	364	10,576	410·86
3	14 March, 1908	256	7,341	257·66
4	7 February, 1909	296	10,099	333·26

On the day photographed Boswe gave 51 lb. milk, testing 3·4 per cent. in the twenty-four hours. Calved twenty-two days.

Manure Experiments at Bathurst Experiment Farm.

R. W. PEACOCK.

As the results of past experiments, it was deemed profitable to apply superphosphate in the general practice of this farm. To test the effect upon the main crops, two widths, or, in some instances, only one width, of the seed drill was left unmanured as a check.

At harvest time equal adjoining portions of manured and unmanured were carefully selected as representing a fair average sample of the whole, and the yields calculated. The differences leading up to the results obtained were strikingly apparent throughout the growth of the crops. These notes are in some measure supplementary to those published in the *Agricultural Gazette* of November, 1906. The conclusions were arrived at after taking into consideration experiments carried out during the past eight years.

The rainfalls for the past three years were—1906, 22·89 inches; 1907, 19·72 inches; 1908, 15·89 inches.

During 1906 unseasonable frosts interfered with the experiments, and only one is tabulated. From this, comparisons were possible by reducing the areas by cutting the frosted wheat for hay on the low-lying portions.

1907.—Paddock No. 12 Federation wheat, manured with 1 cwt. superphosphate; previous crop, maize.

Yield of portion unmanured	...	26 bushels	53 lb.	per acre.
" manured	...	39 "	6	"
Excess due to manure ...	...	12 "	13	"

Results of applications of superphosphate in conjunction with Crop Rotation, 1908. Fair average portions were cut for hay and estimated at per acre.

Paddock No. 2.—Variety of wheat, Cleveland.

Previous Crop.	Manure per acre.	Date sown.	Seed sown per acre.	Date harvested for hay.	Yield of hay per acre.	Increase in hay over unmanured.	Date harvested for grain.	Yield of grain per acre.	Increase in grain over unmanured.
			lb.		t. c. q.	t. c. q.		bus. lb.	bus. lb.
Scarlet clover	1 cwt. superphosphate..	28 April..	28	30 Nov.	2 10 2	1 7 2	16 Dec.	37 40	10 42
Do	Nil..	28 "	28	30 "	1 3 0	....	16 "	26 58	....
Wheat	1 cwt. superphosphate..	28 "	28	30 "	1 2 2	0 14 0	16 "	10 39	6 43
Do	Nil..	28 "	28	30 "	0 8 2	....	16 "	3 56	....
Maize	1 cwt. superphosphate..	27 "	28	2 Dec.	0 11 1	0 3 2	16 "	6 45	3 22
Do	Nil..	27 "	28	2 "	0 7 3	....	16 "	3 23	....

Results from other paddocks.

Paddock No. 19.—Variety of wheat, Cleveland.

Fallow	1 cwt. superphosphate..	16 May .	28	4 Dec.	0 17 3	0 7 3	17 Dec.	17 27	5 47
Do . .	Nil..	16 „	28	11 „	0 10 0	....	17 „	11 40	....

Paddock No. 18.—Variety of wheat, Cleveland.

Previous Crop.	Manure.	Date sown.	Seed sown per acre.	Date harvested.	Yield of straw per acre.	Increase in straw over unmanured.	Yield of grain per acre.	Increase in grain over unmanured.
					cwt. qrs.	cwt. qrs	bus. lb.	bus. lb.
Maize . .	1 cwt. superphosphate.	19 May	32½	22 Dec.	8 0	3 2	13 0	4 5
Do	Nil.. .	19 „	32½	22 „	4 2	....	8 55	....

Paddock No. 26.—Variety of wheat, Bobs.

Maize	1 cwt. superphosphate..	27 May	31	11 Dec.	8 3	2 0	11 40	1 45
Do	Nil..	27 „	31	11 „	6 3	....	9 55	....

* Hay not estimated , straw was instead.

The rainfall during the growth of the crops was made up principally of light showers, and proved altogether inadequate. Where moisture had been conserved and carried over to assist them, good results were obtained. The failures from the crops which immediately followed maize, were due to the fact that the maize crops had pumped the moisture completely from the soils, and the wheats had to make the most of the limited falls during their growth.

The area planted with wheat after wheat was in a better position than that after maize, as the wheat had been removed in December and not April, as was the case with the maize.

The gains from manuring are consistently substantial.

Where the greatest amounts of moisture were conserved the returns were the highest. Notwithstanding the limited moisture, the results were in favour of the manure upon all the above.

From past experiments and observations, it was assumed that there was a condition of fertility in a field that if passed may lead to disaster, especially in dry seasons.

Paddock 2A was treated in order to test when that condition was reached. In Paddock No. 2 the bulk was manured and only check strips left unmanured. In Paddock 2A the bulk was left unmanured, and check strips were manured. The previous crop was rape, which had received 1 cwt. of superphosphate per acre with the seed. A small residue was ploughed under, representing about 18 inches of light growth. The paddock comprised light soil upon the most elevated portion, medium soil and comparatively strong soil upon the lowest portion.

The results were as follow:—

PADDOCK, 2A. Area of Plots, $\frac{1}{160}$ acre.

Variety.	Manure.	Seed sown per acre.	Date sown.	Date harvested.	Yield of grain per acre.	Increase of grain per acre.	Yield of straw per acre.	Increase of straw per acre.	Remarks.
		lb.			bus. lb.	bus. lb.	c. qr. lb.	c. qr. lb.	
Jonathan wheat ..	1 cwt. superphosphate	29½	29 April	16 Dec.	6 25	....	16 2 7	6 1 20	Light soil.
Do ..	Nil	29½	29 "	16 "	10 25	4 0	10 0 15	....	
Do ..	1 cwt. superphosphate	29½	29 "	16 "	9 10	....	18 2 18	7 3 27	Medium soil.
Do ..	Nil	29½	29 "	16 "	9 25	0 15	10 2 19	....	
Do ..	1 cwt. superphosphate	29½	29 "	16 "	4 10	....	17 0 6	7 2 10	Strong soil.
Do ..	Nil	29½	29 "	16 "	11 40	7 30	9 1 24	....	
Algerian oats	1 cwt. superphosphate	45½	30 "	7 "	38 0	16 0	15 2 24	9 1 4	Light soil.
Do ..	Nil	45½	30 "	7 "	22 0	....	6 1 20	....	
Do ..	1 cwt. superphosphate	45½	30 "	7 "	28 0	2 0	17 3 12	8 2 8	Medium soil.
Do ..	Nil	45½	30 "	7 "	26 0	....	9 1 4	....	
Do ..	1 cwt. superphosphate	45½	30 "	7 "	23 0	....	18 3 20	8 2 8	Strong soil.
Do ..	Nil	45½	30 "	7 "	29 0	6 0	10 1 12	....	

NOTE.—Gross return of dry crop weighed; straw estimated by deducting yield of grain.

It will be seen from the above that in this instance the application of 1 cwt. of superphosphate reduced the yield of wheat from 11 bushels 40 lb. to 4 bushels 10 lb. upon the strong soil; or, in other words, a loss of 7½ bushels was induced as well as the cost of manure.

Upon the medium soil the yield was reduced below the unmanured by only 15 lb. and the cost of manure. Upon the light soil the yield was reduced 4 bushels by the application. In the same paddock Algerian oats were treated in the same way as the wheat. They were sown across the different soils, and are strictly comparable in this regard with the wheat.

The application of 1 cwt. of superphosphate per acre upon the strong soil resulted in a loss of 6 bushels and the cost of manure.

Upon the medium soil a gain of 3 bushels resulted from the application. Upon the light soil a gain of 16 bushels was induced.

These results are not consistent with those from the wheat area. It should be noted that the oats were cut nine days before the wheat.

The figures respecting the yields of straw are interesting, and much more uniform. In every instance the application of the manure gave materially

increased yields. In the case of the wheat upon the strong soil the increase of straw due to the manure was 7½ cwt., upon the medium 7¾ cwt., and upon the light 6¼ cwt.

With the oats the manure increased the yield upon the strong soil by 8½ cwt., upon the medium 8½ cwt., and upon the light soil 9¼ cwt.

It is apparent from the above that the increase of the vegetative portions of the crop, straw and flag, induced by the manure was not followed by an increased yield of grain. From observations during growth it could fairly be assumed that the increased development of straw and leaf had the effect of using up the limited moisture of the soil before the grain matured. Upon the strong soil this was very marked; a considerable number of the plants were unable to mature grain, and much of the straw was immature and flaggy. Straw of this character lacks substance, and perishes in the field. This in no small measure accounted for the smaller weight of straw from the strong land than from the medium in the wheat plots.

The crop with the most flag would represent the greatest area of transpiring surfaces for the dissipation of soil moisture. It is apparent that the three different soils in the same paddock required very different treatment as regards manuring under the conditions.

It may also be assumed that the optimum condition of fertility had been passed in some instances, or rather, that condition which was most suitable under the set of circumstances existing throughout the season.

The results of the following experiments in manuring wheats are mostly negative in character, but have a most important bearing upon the problem of manuring. The point of importance is the fact that the manures were applied broadcast upon the following experiments in order to get the exact quantities upon a given area. Upon those tabulated above, the manures were applied by the drill with the seed. There is excellent reason to assume that the application of superphosphate, excepting in large quantities, is not effective unless drilled in with the grain. It is questionable whether superphosphate can be applied profitably without the seed-drill.

The question of applying such manures as sulphate of ammonia with the seed by drill is an important one. Its effect when thus applied upon the soils at this farm has been to retard early development, whereas the application of superphosphate with the seed stimulates early growth. This may in no small measure account for the reduced yields when sulphate of ammonia is thus applied.

The methods of application of different fertilisers are receiving consideration, and in the near future authoritative opinions may be expressed.

There is much in conjunction with the following results which is at present difficult to explain, and enlarged experiments are in progress to throw more light upon them.

It is ifficult to understand the conflicting views held by many farmers upon the application of fertilisers.

Fig. 1.—Wheat after Wheat, Bathurst Experiment Farm.
Wheat manured and unmanured.

Manure Experiments.—Paddock No. 5.

Area of Plots, ½ acre. Varietv—Bobs wheat.

No. of Plot.	Manure per acre.	Yield per acre, 1905.		Yield per acre, 1906.		Yield per acre, 1907.		Yield per acre, 1908.		Average Yield per acre.		Total yield.		Average Yields compared with unmanured.		
		bus	lb.	bus	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb	Average unmanured.	bus.	lb.
1	No manure	29	50	25	14	15	50	4	42	18	54	75	36		75	20
2	Sulphate of ammonia .. . 56 lb Sulphate of potash .. .. 28 lb	30	0	28	48	15	40	7	0	20	22	81	28	+	5	52
3	Superphosphate .. .. .. 112 lb. Sulphate of potash .. .. 28 lb.	31	46	21	2	14	56	8	12	18	59	75	56	+	0	36
4	Sulphate of potash .. .. 28 lb.	28	22	22	52	14	46	5	4	17	46	71	4	−	4	16
5	Sulphate of ammonia .. .. 56 lb.	29	18	24	4	15	22	5	4	18	27	73	48	−	1	32
6	Superphosphate .. .. .. 112 lb.	29	50	23	22	16	4	5	28	18	41	74	44	−	0	36
7	No manure	28	38	24	16	44	16	5	30	18	47	75	8	−	0	12
8	Superphosphate .. .. .. 112 lb. Sulphate of ammonia .. .. 28 lb	30	4	22	28	16	48	5	24	18	41	74	44	−	0	36
9	Superphosphate .. .. .. 112 lb. Sulphate of ammonia .. .. 56 lb. Sulphate of potash .. .. 28 lb.	28	18	28	28	16	12	7	2	20	0	80	0	+	4	40
10	Bare fallow	......		23	28	....		11	56	17	42	35	24	....		

Manures were applied broadcast, and not drilled with seed. The quantities given were applied each year. Wheat was grown continuously for four years upon the manured plots. This practice encouraged wild oats and other weeds, and for this reason the experiment has been discontinued.

Fig. 2.—Wheat after Maize, Bathurst Experiment Farm.
Manured and unmanured.

To compare manured with fallowed portion during the years the fallowed area was cropped.

MANURE EXPERIMENT.—Paddock No. 5.

Plots ½ acre. Variety—Bobs.

No. of Plot.	Manure per acre.	Bare fallow. Yield per acre, 1906.	Bare fallow. Yield per acre, 1908.	Total Yield.	Average Yield per Acre
		bus. lb.	bus. lb.	bus. lb.	bus. lb.
1	No manure	25 14	4 42	29 56	14 58
2	Sulphate of ammonia .. .. .. 56 lb. Sulphate of potash .. .. 28 lb.	28 48	7 0	35 48	17 54
3	Superphosphate .. ..112 lb. Sulphate of potash .. .. 28 lb.	21 2	8 12	29 14	14 37
4	Sulphate of potash .. .. 28 lb.	22 52	5 4	27 56	13 58
5	Sulphate of ammonia .. .. .. 56 lb.	24 4	5 4	29 8	14 34
6	Superphosphate .. ..112 lb.	23 22	5 28	28 50	14 25
7	No manure	24 16	5 30	29 46	14 53
8	Superphosphate .. ..112 lb. Sulphate of ammonia .. .. .. 28 lb.	22 28	5 24	27 52	13 56
9	Superphosphate .. ..112 lb. Sulphate of ammonia .. .. .. 56 lb. Sulphate of potash .. .. 28 lb.	28 28	7 2	35 30	17 45
10	Bare fallow	23 28	11 56	35 24	17 42

This table is inserted as a record, and will be used later in an article upon the subject of fallowing. It is not discussed here.

Fig. 3.—Wheat after Scarlet Clover, Bathurst Experiment Farm.
Manured and unmanured.

MANURE EXPERIMENT, 1906.—Paddock No. 7.

To compare different superphosphates, and to test action of gypsum, slaked lime, and common salt. Manures were applied broadcast.

Area of plots, $\frac{1}{20}$ acre. Variety—Federation wheat.

No. of Plot.	Manure per acre.	Seed sown per acre.	Yield per acre.
		lb.	bus. lb.
1	No manure	36½	29 0
2	Japanese superphosphate, 90 lb.	36½	29 18
3	Superphosphate, 110 lb.	36½	29 10
4	Concentrated superphosphate, 45 lb.	36½	29 56
5	No manure	36½	29 10
6	Gypsum, 225 lb.	36½	28 50
7	Common salt (coarse), 225 lb.	36½	28 32
8	Slaked lime, 225 lb.	36½	30 34
9	No manure	36½	31 12

Manure Analysis—22 per cent. water soluble phosphoric acid.
17 per cent. do do
46 per cent. do do

NOTE.—The amounts of water soluble phosphoric acid applied with No. 2 was 19·8 lb., No. 3 = 18·7 lb., and No. 4 = 20·7 lb., as ascertained by analysis. Seed was sown at the rate of 36½ lb. per acre. All plots were sown on 2nd July, and harvested 21st December.

MANURE EXPERIMENT.—Paddock No. 2.

Manures were applied broadcast.

Varieties—1907, Federation (previous crop oats, 1906); 1908, Cleveland (previous crop tares, 1907).

No. of Plot.	Manure per acre.	Yield per acre, 1907.	Yield per acre, 1908.	Total Yield.	Average Yield per acre.
		bus. lb.	bus. lb.	bus. lb.	bus. lb.
1	No manure	7 56	11 0	18 56	9 28
2	Superphosphate .. .. .. 1 cwt.	10 23	10 23	20 46	10 23
3	Sulphate of potash .. .. .. 28 lb.	10 41	8 33	19 14	9 37
4	No manure	12 13	7 1	19 14	9 37
5	Sulphate of ammonia .. .. 56 lb.	8 51	10 23	19 14	9 37
6	Superphosphate .. .. .. 112 lb. Sulphate of potash .. .. .. 28 lb.	11 18	3 21	14 39	7 19
7	No manure	8 33	3 58	12 31	6 15
8	Superphosphate .. .. .. 112 lb. Sulphate of ammonia .. .. 56 lb.	8 15	10 5	18 20	9 10
9	Superphosphate .. .. .. 112 lb. Sulphate of ammonia .. .. 56 lb. Sulphate of potash .. .. .. 28 lb.	8 15	9 10	17 25	8 42
10	No manure	16 48	12 13	29 1	14 30
11	Sulphate of ammonia .. .. 56 lb. Sulphate of potash .. .. .. 28 lb.	14 40	14 58	29 38	14 49
12	Common salt.. .. .. .. 224 lb.	15 16	18 38	33 54	16 57
13	No manure	16 30	13 8	29 38	14 49
14	Gypsum .. .. 224 lb.	14 3	12 50	26 53	13 26
15	Quicklime .. .. 224 lb.	17 43	16 48	34 31	17 15
16	No manure	14 3	13 26	27 29	13 44
17	Slaked lime .. .. 224 lb.	14 58	16 11	31 9	15 34
18	Sulphate of iron .. .. .. 224 lb.	16 30	15 16	31 46	15 53
19	No manure	15 53	16 48	32 41	16 20
20	Stable manure .. .. .. 5 tons	19 15	16 30	35 45	17 52
21	Sheep manure .. .. .. 5 tons	21 5	15 53	36 58	18 29

MANURE EXPERIMENT.—Paddock No. 2—*continued.*

No. of Plot	Manure per acre.	Yield per acre, 1907.	Yield per acre, 1908.	Total Yield.	Average Yield per acre
		bus. lb.	bus. lb.	bus. lb.	bus. lb.
22	No manure	17 25	15 35	33 0	16 30
23	Magnesium sulphate 56 lb.	16 30	14 40	31 10	15 35
24	No manure	16 48	16 30	33 18	16 39

NOTE.—All manured plots are adjacent to an unmanured one, and should be compared with one alongside.

The following tables refer to manuring of maize and cowpeas. The manures were applied by the drill with the seed.

In past experiments with maize no results were obtainable, as the manures had been always applied broadcast. Results were forthcoming as soon as the manures were applied by drill with seed.

MANURE EXPERIMENT.

Maize 1908–9, upon light wheat soil.—Paddock No. 6.
Variety of maize, Riley's Favourite (manure applied by maize drill with seed).

No. of Plot.	Manure per acre.	Estimated Yield per Acre.	Area of Plot.
		bus. lb.	
1	Unmanured	11 51	$\frac{3}{22}$ acre.
2	Superphosphate .. .. 66 lb.	17 52	,,
3	Superphosphate .. .. 102 lb. Sulphate of ammonia . .. .. 51 lb.	17 38	,,
4	Unmanured	9 31	,,
5	Superphosphate . .. . 96 lb. Sulphate of potash .. . .. 24 lb.	10 48	,,
6	Superphosphate .. .. 94 lb. Sulphate of ammonia .. .. .. 46 lb. Sulphate of potash .. .. .. 23 lb.	15 54	,,
7	Unmanured	11 7	,,
8	Sulphate of ammonia .. .. .. 41 lb. Sulphate of potash .. .. .. 20 lb.	15 18	,,
9	Sulphate of ammonia .. .. .. 62 lb.	7 55	,,
10	Unmanured	14 0	,,
11	Sulphate of potash . .. .. 29 lb.	12 54	,,
12	Unmanured	14 8	,,

Seed sown 15th October, in drills 5 feet apart, at the rate of 4¾ lb. per acre; harvested 28th April.

MANURE EXPERIMENT with Cowpea, 1908-9.

Paddock No. 5.—Variety of Cowpea, White; manures drilled in with seed.

No. of Plot.	Manure per acre.	Area of Plot.	Yield of Grain per acre.
			lb.
1	No manure	$\frac{1}{20}$ acre	250
2	Sulphate of ammonia ... 100 lb.	,,	20
3	No manure	,,	180
4	Superphosphate ... 88 lb. Sulphate of ammonia ... 44 lb.	,,	160
5	Sulphate of ammonia ... 94 lb. Sulphate of potash ... 46 lb.	,,	40
6	No manure	,,	160
7	Superphosphate ... 74 lb. Sulphate of potash ... 36 lb.	,,	150
8	Sulphate of potash ... 50 lb.	,,	90
9	No manure	,,	110
10	Superphosphate ... 64 lb. Sulphate of ammonia ... 32 lb. Sulphate of potash ... 16 lb.	,,	150
11	Superphosphate ... 100 lb.	,,	140
12	No manure	$\frac{1}{10}$ acre	140

All were sown on the 27th November, and harvested 27th April. They were sown at the rate of 4 lb. seed per acre, in drills 3 feet apart.

As regards the method of application, it is interesting to note that the results from superphosphate when applied by the drill with the seed are consistently satisfactory; when applied broadcast, such is not so. In the results of experiments published in *Gazette* of November, 1906, the manures of experiments A, B, D, and E were applied broadcast.

Those on experiment C were drilled with the seed.

The large quantity of superphosphate applied broadcast to Experiment A, viz., 300 lb. per acre, may in some measure act as a smaller quantity applied with the seed by drill during the first year.

It would appear that the most economical system of applying superphosphates would be in small, yet sufficient, quantities with the seed each year, to give that vigorous initial growth which is so marked when superphosphate is applied with the seed. This aspect of the question is receiving further attention.

Strangles.

C. J. SANDERSON, M.R.C.V.S., Government Veterinary Surgeon.

Definition.

STRANGLES is an infectious disease of the horse, mule, and ass. It is seen usually in young animals that have been brought into stables for the first time, but may occur in those running at grass also. After recovery the animal is immune to the disease, and this immunity is usually life-long.

The cause of strangles is infection from an animal suffering from the disease, or indirectly through contact with the discharges from those affected. All the morbid discharges are contagious. A predisposition to contract strangles might be caused by a common cold, which prepares the tissues for the reception of the micro-organisms.

Livery stables, where many horses of all ages are stabled, are ideal places for spreading the disease.

Symptoms.

Very often the first symptom noticed is a swelling between the branches of the lower jaw; but, as a rule, the animal is noticed to be dull and off feed for a day or two before active symptoms develop. Then a hard, dry cough is heard, followed by a running from the nostrils, which is at first watery, but soon develops into a thick, slimy discharge, with purulent matter mixed with it. As the disease progresses the coat stares, the mucous membrane of the eye, if examined, will be found to be red, the temperature rises, and the pulse is quickened. Usually the breathing is slightly accelerated, due to the blocking of the air passages with mucous. The swelling below the jaw becomes hot, tender, and may break and discharge a thick, yellowish pus. This hot, painful swelling is usually considered the most characteristic symptom of strangles. After the abscesses break or are lanced, and the nasal discharge becomes well established, the fever abates and the appetite returns. This is followed by a progressive decrease of the nasal discharge, and at the end of ten days or a fortnight the animal is well.

The foregoing is the usual course of events in strangles, but the disease may assume a malignant form, or complications may arise which may prove fatal. The swelling below the jaw may become excessive, extending down the throat and up as high as the ears. Abscesses may form in any part of the body, including the lungs, brain, and abdominal cavity. In the latter case the animal shows symptoms of colic, while, if the lungs become affected and full of discharge, the breathing will become laboured, the

flanks heave, and great distress will be shown. A common symptom is inflammation of the larynx. When this occurs swallowing is impeded, and fluids are returned through the nostrils.

Another complication appears in an inflammation of the skin of the head, when small abscesses appear on the lips, cheeks, nostrils, and other head parts, accompanied by a more or less severe swelling of the affected parts.

Pneumonia may also occur from food finding its way down the windpipe owing to the difficulty in swallowing, due to the swollen condition of the throat.

The disease may become chronic, in which case the nasal symptoms do not completely disappear. The above are the principal complications.

Treatment.

Isolate the animal, and use separate buckets to feed and water it. Treatment is simple, and aims at the prevention of complications which may prove fatal. Keep the patient warm and well covered. This will assist in the prevention of pneumonia and bronchitis. Steam the head three or four times a day with the vapour of hot water in which a little oil of Eucalyptus has been placed. This will allay the inflammation of the mucous membranes, ease the cough, and promote discharge from the nostrils. Do not place the head in a bag to steam it, but hold it close down over the bucket. It is a good plan to keep a sick horse in the paddock, where it usually holds its nose to the ground and freely discharges the morbid matter. Treatment of the swellings between the jaws is of the greatest importance. Keep hot linseed meal poultices on continually, and as soon as the abscess softens it should be opened at its lowest point. If abscesses do not come to a head quickly, they should be rubbed with thick mustard and water, particularly at their lowest point, in order to induce them to do so. If the pus is not let out, it will burrow in the tissues under the skin, and often result fatally. After the abscess has burst or been opened, the treatment to be followed consists in dilating the opening to give free discharge to the pus, and in washing out the abscess cavity with warm water, to which a little lysol has been added. A teaspoonful of lysol to a pint of water will be sufficient.

In severe cases where there is acute laryngitis, shown by difficulty in swallowing and return of fluids by the nostrils, when a distressing cough is present, and a loud noise produced during inspiration, a smart mustard blister should be applied to the region of the throat. This usually gives speedy relief, and is better than poultices. Feed on warm mashes, steamed hay, and generally tempt the appetite, as if food is refused there is great danger and difficulty in forcing nourishment on a horse with strangles.

Green food, when obtainable, is recommended.

The administration of drenches is impossible in many cases in consequence of the sore throat. It is better to give medicine in the food or water, or by placing it on the back of the tongue with a smooth stick.

The following is good to allay irritation of the throat:—

Extract of belladonna, 1 ounce.
Chlorate of potash, 2 ounces.
Boracic acid, powdered, 1 ounce.
Glycerine, 2 ounces.
Honey or treacle to make 8 ounces.

Dose.—Give two tablespoonsful on the back of the tongue three or four times a day.

Two ounces of Epsom salts in the drinking water three times a day is good to reduce fever.

Chlorate of potash given twice a day in dessertspoonful doses in the drinking water is also a good treatment.

Prevention.

The micro-organism which causes strangles seems to be able to live outside the animal's body for a very long time, and thence to infect susceptible horses. It is therefore necessary, in order to prevent future cases, to thoroughly disinfect the stables used by animals suffering from this disease. Scrub the buckets, manger, and woodwork of the stalls with boiling water, to which some reliable disinfectant has been added. Sprinkle lime on the floors and limewash the walls.

The Cost of a Bad Collar.

Some people have an idea that so long as a collar is sufficiently bulky and strong-looking it will serve for any horse. When ploughing time comes round, and the hardest work of the year commences, on to raw youngsters and the bloated elders go great collars. Of course, almost any horse after a fair spell from work may get a bit tender about the shoulders during his first few days at ploughing, but it is also not by any means uncommon to see quite a large proportion of the horses on a holding practically incapacitated at a most critical time through lack of care in getting well-fitting collars.

The loss of time, and in ticklish seasons, of favourable sowing opportunities, in this respect must be very considerable.

The subject is one that is not worth preaching about. There are three ways or so round the difficulty:—

First: Let each horse have his own collar, and be sure that it fits him as well as possible.

Second: Be sure that you so adjust the hames as to give him the fairest and most effective pull.

Third: Take care of the collar, and keep it as clean as possible of cake sweat.

Plant Bug Pests.

WALTER W. FROGGATT.

DURING the last two months the most general, widespread, and injurious insect pests (after the pumpkin beetle) have been several species of plant bugs.

While the Order *Hemiptera* contains some carnivorous bugs which destroy plant-eating insects, such as the very useful vine-moth bug, there are among the plant-destroying species some of our most noxious insects, and these are very difficult to deal with in a satisfactory manner. They do not eat the surface of the bark or foliage, but, furnished with a sharp-pointed beak, they press it through the skin and draw up the sap beneath. It is therefore no use spraying the foliage of the infested trees with any arsenical poison to kill them. Again, they appear, like the Rutherglen bug, in countless millions, are very active, covered with a stout shield-like covering on the back, and discharge an offensive fluid from glands on the body, producing a "buggy" smell, which renders them distasteful to birds and other predaceous insects that otherwise might feed upon them. They are not only found on the exposed surface of the plants, but cluster under the foliage and often swarm upon the ground, sheltered under the growing plant.

The most effective contact poison is kerosene emulsion, but it should be sprayed well under the plants as well as over them. If done early or on a dull day it will give the best results, as the bugs are not then so active as later on.

When the plants are in rows, a shallow dish containing oil and water can sometimes be dragged up between the rows, and the bushes or plants beaten with brooms or branches so that the insects fall into the dish and are killed in the oil and water placed in the bottom. Smoke may also be used with advantage, particularly on a small plot in a garden; but the smoke only drives them away, and does not kill them. Clearing up and burning all the rubbish and grass round the crop, in which they often seek shelter before coming into the cultivated crop, and wherein they often deposit their eggs, will be a great help in fighting them.

When fruit-trees are infested with them, a large shallow dish should be made out of a sheet of iron, with the edges turned up so that it will contain an inch or two of water with a skin of kerosene on the surface. Half a pint of kerosene will cover a large dish. This dish, used like a hopperdozer, is dragged under the tree and each branch is jarred over it. Wrap a pick-handle or stout stick with a bit of bagging (so that the bark is not bruised), and use it as a club, tapping each branch sharply. The jarring does not shake the more or less ripe fruit off, as shaking the branches would do. It is an unnatural shake to the insects, which are used to the shaking of the wind, but not to the sudden jar, and they fall much quicker in consequence.

The dish can be emptied as the bugs accumulate, and recharged. If this work is undertaken early in the morning when the pests are resting, very few will attempt to fly.

A sheet spread under the tree and wetted with kerosene emulsion, of which a canful can be kept alongside to sprinkle the fallen bugs from time to time, will act instead of the "hopperdozer dish," and may be more handy on rough ground.

The bugs which have been so troublesome this season are:—

(1) The Rutherglen Bug (*Nysius vinitor*).—A tiny silver-grey bug, that swarms on tomato, potato, lucerne, wheat, and other crops, and in orchards sucks the sap of ripening fruit and grapes.

(2) The Brown Ground-bug (*Dictyotus plebijus*).—These live among dry rubbish on the ground, and from some unknown cause have become so abundant this season that they swarm in wheat-fields, and are damaging fruit. It is a dull brown-coloured bug, under ¼ of an inch in length, broad in front behind the head, and angular to the tip of the body. It is a pest in the southern and western districts.

(3) The Cherry Bug (*Peltophora pedicellata*).—This is one of the larger, rich metallic-green coloured, oval-shield bugs, up to ½ inch in length. It is common in the Gosford district, and has a wide range. It confines its attention to ripening fruit.

(4) The Bronzy Orange Bug (*Stilida indecora*), which is often very troublesome on the Northern Rivers. They cluster round the base of the stalks of the fruit, and by sucking up the sap cause the fruit to drop before it is ripe. This is one of our largest shield bugs, of a general metallic bronze-brown tint. Fumigation with hydrocyanic acid gas has been used successfully against this pest, and might be used under favourable conditions with some of the others previously noted.

Grub in Sorghum Heads in the Grafton District.

Some time ago the Manager of the Grafton Experiment Farm reported that a great many heads of sorghum on the Farm were being destroyed by grubs, which formed a web all over the seed-head. Specimens were submitted to the Entomologist, who now reports that moths have emerged, and have been identified as the "Northern Peach Moth," *Dichocrocis (Conogethes) punctiferalis*, described in the *Agricultural Gazette* of February, 1897, as a pest upon peaches at Casino.

Notes on the Early Growth of Wheat.

Methods of Controlling same.

MARK H. REYNOLDS.

When it is possible to accurately forecast the weather for weeks instead of hours, the most successful agriculturist will be the one who has the best knowledge of his calling, with sufficient energy to practically apply it. Under present conditions he must be somewhat a speculator, and a big-hearted individual in addition.

Unfavourable seasons—especially last year—have tended to make farmers over-cautious, with the result that this season, although the year opened out with good rains, expediting ploughing operations, early seeding, which is considered the *sine qua non* of success, was in many instances not carried out. Midseason, May, seeding time was in many districts risky, due to a few weeks of dry weather. Late seeding, June-July, was performed under difficulties, owing to abundance of rain early in June. From what one may observe at this stage of the season, it would be correct to say that, with few exceptions, medium early and midseason seeding was the correct period.

Owing to the poor average grain and hay yield in 1908, the fertility of the soil was not impaired. The soil for last season being in good heart, and weather favourable, a vigorous early growth was the result of early sowing, with the exception of the highlands. On open, porous soil early-sown wheat, March-April, had attained a height of 18 inches to 2 feet in June, a growth that would have been considered satisfactory three months later.

On similar country with midseason, May, seeding, the wheat had made a 12 inches growth early in July, whereas on soil of the loam to clay-loam texture, in like localities, growth was not so forward, due, in a degree, to the soil being saturated with water.

A considerable area was late sown in the Central Western District, and by the middle of August plants from seed sown at this time were well above ground, with the exception of crops on the highlands, where excessive rain has lately retarded growth, and an instance was brought to my notice where the grain had rotted in the soil.

Methods adopted to reduce too prolific early growth when the production of grain is the objective.

The usual method in vogue all over the State is to feed off with stock. Some farmers make it a yearly practice to turn sheep on the wheat as soon as the plants are above ground, and leave them there until the latter part of July. Others, again, await the summer season, and only feed off if the growth

is considered too forward or rank and flaggy. In such cases stock are more or less unsatisfactory. Sheep overrun the paddock in search of young, short, sweet plants, and neglect anything rank. Cattle are more useful to remove rank growth. Horses are the least desirable of the three.

There are soils of open texture on which the plants are benefited by the soil being consolidated—the free-working, deep loams. Where such soils occur in a district, and also where spring rains may be counted on, removing surplus growth by feeding off with stock would be advisable. It is an open question whether making a general practice of feeding off on all soils, irrespective of weather conditions, has not something to do with the rapidity with which a serious turn takes place in harvest prospects when a rainfall shortage occurs.

Example of 5 months' growth, Winter, 1909.

There is no question that the tramping by stock for weeks in all weathers on soils that naturally consolidate too quickly causes an excessive evaporation from the soil in the hot, dry months to harvest time. Injury to a forward crop is also caused by stock trampling down plants, which later rot off. Constant nibbling of the plants may also cause too abundant stooling in certain stages of early growth. Harrowing after the removal of the stock has a beneficial effect by reducing surface tension of the soil; but the benefits of such are lost should light showers occur at a period when further harrowing would be detrimental. Such showers again consolidate the shallow cultivated soil, and the state of the soil is favourable to rapid evaporation.

Consolidation of the soil 3 inches below the surface before or at the time of seeding would be a sounder system with soils requiring packing than consolidation of the surface 3 inches by tramping with stock.

Any method to supersede feeding off must be applicable to mixed farming, for it has been so often demonstrated that combining stock and crops is a

sound policy for the farmer. If, however, the system of conducting mixed farming, say, with wheat and sheep, is faulty, the sooner it is put right the better. The system of feeding off in all cases now being questioned had many champions some years ago, when spring rains could be almost depended upon. Stock, especially sheep, convert a portion of the overgrowth into plant-food, which is returned to the soil in the droppings. Rain carries a portion of this to the roots, and produces increased vigour in the plants, the harvest being a reflex of such vigour. Conditions have somewhat changed during the last few years, spring rains being light, and occasionally absent. It is partly due to such a change of circumstances that fallowing and cultivating the soil for months before seeding has become a practice with many farmers, the object of such a system being to increase the moisture-holding capacity of the soil, and to retain as much moisture as possible from natural sources. Any system of removing growth should be one that will least affect such a desirable state in the soil, and cope with the trouble in an expeditious and thorough manner. There is a further reason why a system is required in lieu of stock for controlling growth, and that is, that sufficient stock are not always available. Farmers were in most cases understocked last year, having reduced their flocks on account of shortage of feed in 1908. Due to this, a number of forward crops were not reduced. Such fields would be better cut for ensilage or hay later on.

When the objective is grain, cutting with a quick-knife-action reaper and binder if the growth is 15 inches or over, and with a back-delivery mowing machine for shorter growth, is an advantageous method for a too-forward crop.

Should the growth have reached a stage when the lower portion of the stem is hollow, or, to state it another way, when the growing point would be destroyed by cutting, necessitating the plant sending up fresh shoots from the stock, the vigour of the plants will be somewhat impaired, and the plants may, if weather conditions are dry at the time, die off, or, if moist conditions prevail, send up a number of shoots. It is therefore inadvisable to cut or feed off a too-mature growth.

On 24th June I visited Mungeribar, and suggested mowing the very forward plots of wheat on the Farmers' Experiment area. For this purpose a mowing machine was used; and as Mr. Bragg, who was conducting the plot, had no use for the fodder, herbage being abundant, I removed the swarth-board, so as to let the cut portion fall evenly over the ground. Some seven plots were mown, the plants being up to 18 inches high. The Comeback wheat was too forward, and a few instances of ear-formation were noted; but the growth was somewhat uneven, due largely to the uneven distribution of moisture in the soil at seeding time. I visited Mungeribar on 7th August, and found all the plots looking well, the wheats having made a new growth of 3 inches of stem. Except Comeback, there was no noticeable additional growth from the root. With Comeback, where the stems cut were hollow, a number of fresh stools have

grown out from the crown. It will be interesting to note whether the "self" mulch on these plots will materially aid the conservation of soil moisture by retarding evaporation. If such occur, an increased yield should be obtained from plots so treated over check plots, if dry weather prevail to harvest time.

At Maryvale similar work was carried out.

Mr. P. O'Neill, of Narromine, seeded with Steinwedel wheat, the latter part of March, some 80 acres of land cleared of timber twelve months. The growth in June was uneven—generally the result on "new" country; and up to 2 feet high. Mr. O'Neill feared this would "lay" during the

A . B C

Experiment to determine correct stage of growth at which to mow or feed off.

A.—A growth like this may best be allowed to grow without reduction.

B.—Too far advanced to be mown or fed off without affecting subsequent growth and yield.

C.—Just at right stage to be fed off or mown with advantage to subsequent growth and yield.

period to harvest. On 24th June I suggested cutting this with reaper and binder, mixing the mowings with a $\frac{1}{3}$ proportion of straw and threshings from last year, and stacking for silage. On Thursday, 15th July, we started stacking, and by Saturday evening, when I left, had some 50 tons stacked. This was taken off 20 acres. The stack has basal dimensions of 16 feet x 14 feet.

The stack was weighted with earth, and thatched all round with Johnson grass, to minimise the effects of dry winds. On 7th August I found the temperature high. The straw had mellowed with the green stuff, and the stack looked promising. The portion mowed had made fresh stem growth from the top of the old stems, except in the case of rank, coarse patches, where growth had started from the root, or plants had died outright.

The reduction of the growth by some method was felt to be a necessity, to allow daylight into the crops to check fungoid growths and to minimise the risk of laying.

However, a dry spell set in about the time of mowing the crops, and the proportion of forward crops that went down ultimately was minimised. A rough estimate by Mr. O'Neill of the Steinwedel wheat mown is 18 bushels to the acre, whereas Steinwedel adjoining that did not require mowing went 22 bushels.

The foregoing experiments on treatment of early growth were conducted with the object of producing favourable conditions of plant-growth for grain production.

A B C D

Results of mowing to check forward growth.

A.—Mown too late; plant killed.
B.—Mown at right time; continuous growth.
C.—Mown too late; plant stooling feebly.
D.—Wheat sown at time A, B, C, were mown. It will be noted that the second growth of B is far in advance of the main growth of D.

As before stated, a large area of early and midseason sown crops will not have the rank growth reduced.

With favourable weather, the farmer will need to use some judgment as to whether the crop will "lay" before grain time, and act according; cutting for silage if this is likely to occur. In the advanced stage in the spring the plants will make a more nutritious silage than if cut earlier. With dry spring conditions, the early-sown crop could be cut for hay in September or later.

Farmers in the dry western wheat area generally sow for grain; but in a season like the present, where the early growth has reached such proportions, due to a favourable autumn, it would pay them to harvest for silage or hay. The prices for straw last year at Narromine was £4 per ton, and there is an ever-recurring shortage of natural herbage in the West, so that there would be no doubt a profitable market for silage or hay.

A farmer should be ever ready to change from one method to another, when it will be remunerative to do so, a basis of action being the prevailing weather—far better and less costly than fighting Nature.

Stack silage at Narromine.
(From mowings of forward growth of wheat mixed with straw—5 weeks after building.)

A SUMMARY OF SUGGESTIONS.

General.—Maintain by any system of removal of growth the nature of soil favourable to moisture retention and plant vigour.

Specific.—When grain is the objective, keep the young growth in check with—(*a*) stock, if consolidation of the soil is desirable, or where spring rains are sufficient for grain development; (*b*) by mowing, where the reverse conditions of soil and climate occur; (*c*) when the object aimed at is the best crop for either silage, hay, or grain, sow early and midseason, and be ruled by weather conditions.

Results of the harvest at Touri, where plots of early-maturing wheats were mown, show yields from 16½ to 23½ bushels. Frost had some effect in reducing yields. All early-maturing wheats were mown, so that a comparison cannot be made.

At Mungeribar, plots of Bunyip (early maturing) treated with superphosphate 56 lb. to the acre yielded 20 and 12 bushels. The former was

mown and the latter untouched. Such a difference would indicate that mowing was distinctly beneficial, but the season was so peculiar in many respects that further trials would be necessary before the system could be called a sound one. It can be said, however, that such results would imply that the system of reducing a too abundant growth by mowing, provided the plants are not over-developed, is not detrimental. In a season like the one we have passed through, when autumn weather was so favourable to growth, and when the objective of the farmer was grain, such treatment would have made for a sure crop. This would have been more emphasised had the

Injurious effects of late mowing or feeding off.

spring weather been equally favourable to growth as the autumn. Had such occurred, many crops that had made an abundant growth in autumn and early winter would have "laid," and the result would have been a much diminished return.

It is well to reiterate the fact that feeding-off is a sound system on some open soils, and good returns often follow such treatment; but in an abnormal season, when sufficient stock are not available, and in parts where consolidation of the soil is detrimental, mowing a too abundant early growth may prove the salvation of many crops.

Butter Faults.

Cloudy Brine or Moisture.

GEORGE S. STENING.

There are no faults having a more serious effect on our butters at the present time than those of manufacture.

In a very great number of instances proficient cream grading has been militated against by some such errors, and a butter that, under ordinary conditions, should grade into "first-class" is graded into "second-class," a state of affairs that must be a source of concern and annoyance to the factory manager, and of loss to the producer.

It is on account of this latter phase that this paper is prepared, in the hope that those so offending may so remedy the evils now existing as to bring about a state of affairs that will be more cheering to themselves and remunerative to the producer.

We heard much at the recent Factory Managers' Conference concerning the delivery of a sound raw material at the factories, many asserting that this was all that was required. Truly this is a laudable object for managers and others engaged in the industry to assist in bringing about; but to my mind, before the goal of every manager's ambition is aspired to, viz., to produce an article of a standard and uniform quality, our methods, and especially those in connection with the manufacture, will almost universally have to undergo a complete change. I do not for one moment assume that the majority of our managers are not competent to manufacture butter so as to produce the best results, but what I do say is, there is too much slip-shod, taken-for-granted sort of work, too much of the "old school" ideas, and the best results are not obtained from the raw material supplied at a great number of our factories.

There are several factors conducing to this state of affairs, the chief being that many of our factories are so inadequately equipped, in so far as space and machinery is concerned, that they cannot satisfactorily or systematically handle the supplies, the consequence being that methods which tend to expeditious work, regardless of results, have to be adopted to enable them to cope with the work. I know of factories so equipped as not to possess sufficient storage capacity for their cream, which means that the cream, on arrival at the factory, and subsequent to grading, is pumped over the cooler and run direct into the churns without blending. Can anything but disastrous results to texture ensue? Especially, too, when it is taken into consideration that the various processes have to be rushed through, so that the work of the factory can be finished in the daylight. The directors of such factories (and they are generally producers) are perhaps more to blame

for this state of affairs than the manager, because, on account of a short-sighted policy, they will neither increase their plant nor buildings on the score of expense, but are content to see the sovereigns weekly, monthly, and yearly slip from them, which would more than cover the whole expense in one season.

Assuming, as is very often the case, that a butter graded 88 points instead of 90 points (the points necessary to bring it into first-class being lost through defective manufacture), it is paid for at the rate of 2s. per cwt. off top rates. A factory exporting, say, 10 tons per week, would therefore lose £20 per week, and it is easy of calculation what this would mean in a season's export—a sum, part of which the suppliers would gladly volunteer towards additions and improvements.

Perhaps the most vital defect in our butters at present is "cloudy brine or moisture." I say it is the most vital because it affects in a greater or less degree the flavour, texture, and condition of a butter when graded, according to the intensity of such "cloudiness."

It would be well to understand what is meant by this term, so that a greater importance will be given it in future.

By "cloudy brine or moisture" I mean *any* degree of alteration in the colour of the moisture of a butter from the transparent—practically any discolorisation of the water used in the manufacture of a butter contained in the finished article. It varies from a slight "cloudiness," resembling the lustre of a pearl, to a distinct "milkiness," whereas the correct moisture should sparkle like a diamond. No better simile could be found to force home the difference between a clear and a cloudy brine as that used above, the diamond and the pearl.

Causes of Cloudy Brine.

It is caused or produced from one, or a combination of, the following:—

1. High churning temperature, or of the wash water.
2. Insufficient or ineffective washing.
3. Churning the grain irregularly.
4. Churning the grain too large.

It will be at once seen that, with the exception of 2, the other errors are the cause of inferior "texture," and it is significant that generally "cloudy brine" is associated with butters that are grainy, loose, and open, all of which are texture faults.

Having in a previous paper dealt rather exhaustively with the evil effects resulting from the above faults, reasons why, &c., it is not my intention here to recapitulate the contents of such paper any more than I can help, but rather to deal with them in such a way as will assist in overcoming their effects, and the causes for same.

High Churning Temperature.—There is no factor responsible for so much trouble in butter manufacture as the churning of cream at high temperatures. By high temperatures I mean to imply any temperature that will destroy the firm, distinct, granular form of a well-made butter. Better

is it to err on the side of a low degree than of a high, yet more often than otherwise is the latter course adopted, with always fatal results. Be it said in justification of some makers that this error is forced upon them by lack of refrigerating power, and notwithstanding long and constant cooling they cannot reduce the temperature to that desired. To the factory which has so outgrown itself as to possess insufficient refrigerating power to thoroughly overcome and maintain the temperature of the cream, butter, &c., I would strongly urge the great necessity of at once increasing it power by a duplication of plant, or preferably with an increased capacity machine. It is obviously false economy to continue work under the above conditions, but there is an excuse for those who perforce have to do so. On the other hand, there are makers, with ample power and to spare, who so disregard the necessity of proper temperatures, that they resort to high temperatures, as a means of expediting the work of the factory, as it facilitates churning, handling, working, and packing of the butter, and this is done regardless of results. Another means of bringing about similar results as the above, and which is done, I think, with the very best intentions by those adopting the system, was touched upon at the opening of this paper, viz., the cooling and churning of cream soon after receipt at the factory. The practice is to pump the cream, immediately it is graded, over a pipe-cooler into a vat, and then direct into the churn. This cannot be accepted as a thorough cooling of that part of the cream which it is so necessary to cool, viz., the fat, because, on account of its non-conductive properties, it has not had sufficient of the cold influence to reduce it to the same temperature as the serum, or watery portion of the cream. The cream should stand at least two hours under cooling influences before the fat globules are thoroughly cooled. (This, too, is really the reason why a cream rises in temperature somewhat rapidly when first placed in the storage vats, after running over the cooler; not altogether on account of the atmospheric influence, which naturally slightly affects it, but rather on account of the serum absorbing the warmth from the fat globules. Where such methods are adopted it will be noticed that unless the greatest possible care is exercised in the churning, with frequent washing down with a very cold wash water, the butter will break soft and greasy, afterwards gathering too quickly, and then no amount of washing will cleanse it of the incorporated buttermilk—result, "cloudy brine or moisture."

Much of the good work following the adoption of correct churning temperatures is seriously impaired by the use of a high temperature wash water, which produces results (according to the temperature) similar to those following a high churning temperature. Here again many factories suffer from an inadequate supply of cool water, but I would point out that it is not always the capacity of water available at fault so much as the system adopted for the cooling of it.

"Insufficient or ineffective washing of the butter is a common cause." Often does it happen that the butter made under the best influences is so improperly washed as to cause this evil. As a general rule, it is the practice to wash the

butter only once; and then, after running this washing off, to hose the butter as a second washing. This latter method has little or no effect as a means of cleansing. The second washing should be done in exactly the same manner as the first; and then, if the water appears cloudy or slightly milky, a third washing similar to the two previous will be found sufficient. It will be asserted by some that it is impossible to get a perfectly clear brine, but this is not so. I will admit that even in our best-made butters there is a faint cloudiness, which, while it should not exist, is not altogether taken exception to, and only in cases when this faint indication is exceeded does it point to one or more of the errors enumerated.

The third and fourth causes can be taken together, for they are so much allied in their relationship as causing "cloudy brine." They are both due to errors in churning, the former in the initial and the latter in the final stages of the churning operation. A passing reference only is necessary to these errors, as their causes and effect have been fully gone into in a previous paper. Suffice it to say that, generally speaking, cloudy brine is associated with butters showing these faults.

Effect of Cloudy Brine or Moisture.

As pointed out previously in this paper, "cloudy brine" affects, in a greater or less degree, according to the intensity of the cloudiness, the flavour, texture, and condition points of a butter. It imparts to the flavour a stalish and sometimes oily and dull taste, whereas the aroma is generally sour—exactly similar to that of old buttermilk. This flavour increases rather than diminishes with age and storage, and therein it is that an export butter suffers from its presence. The texture is affected not so much in its physical condition, as from the cloudy indication of the moisture, which is included under the heading of texture.

It nearly always happens that the colour of a butter is rendered imperfect by being "mottled" when it contains "cloudy brine." It is brought about by the action of the salt on the casein contained in the "cloudy moisture."

It will thus be seen from the foregoing that a butter is more seriously affected by this defect of manufacture than from any other, yet it is one regarded by too many makers as trifling.

The purposes of this paper have been excellently served by the data supplied by one of our progressive factory managers, who, being anxious to bring about an improvement in his butter, which had not been grading up to his expectations, forwarded six separate boxes of butter (made under varying conditions, and marked 1 to 6) to Sydney for report. An extract from his letter, and the results of the examination, will, I feel sure, prove both interesting and conclusive evidence of the effects of a "cloudy brine," and at the same time of distinct educational value.

The letter read as follows:—"Churnings marked with blue pencil 1, 2, 3, 4, 5. (I would here point out that a sixth box, marked as above, was received and reported upon.) Washed twice, *temperatures slightly high,* owing to shortage of ammonia; 1, 2, 3 fine grain; 4, water rather high, and gathered

rather large; 5, best grain and water temperature good. Cream received up to 2 p.m. to-day, cooled at 4 p.m., two hours' blending, constantly stirred. *We finished churning 10 o'clock p.m.*"

It will thus be seen that the butter was made from cream blended in the one vat, and treated under the same influences.

The results of examination, showing the grading and remarks, are as follows:—

No.	Flavour.	Texture.	Condition.	Total.	Remarks.
1	40	28	19	87	Slightly sour, flat after-flavour, cloudy brine, mottled.
2	40	28	18	86	Flat after-flavour and oily, loose and moist, cloudy brine, mottled, heated surface.
3	40	28	19	87	Slightly sour and oily, grainy and moist, cloudy brine, mottled.
4	40	28	19	87	Slightly sour and oily, grainy and moist, cloudy brine, mottled, slightly heated surface.
5	42	29½	20	91½	Flat, trifle greasy.
6	42	29	19	90	Flat, trifle moist, slightly mottled.

The results speak for themselves, and comment on them seems to me unnecessary.

The manager called at the grading depôt three days after the examination, and was shown some of the butters, and verified the results. He expressed himself as well satisfied, though surprised that "cloudy brine" had such an effect upon his butter, especially, too, as the cream was similar for each churning.

Only last month another manager forwarded three boxes for report, with practically similar results, the box showing the presence of "cloudy brine" grading three points less than the best box with clear moisture.

The remedy to prevent a recurrence of the evils resulting from "cloudy brine or moisture" are therefore not far to seek. Adopt methods, in the first place, that will tend to the exclusion of buttermilk in every shape and form, even to the minutest trace; and secondly, that tend to the production of a butter with a uniform grain, thereby greatly assisting in the former object.

I do trust that this paper may be the means of bringing about changes in the manufacture of our butter, so that, notwithstanding the increased keenness of competition in the world's markets, we may hold our own as regards quality and values, and so benefit not only the producers of the raw material, but the State generally.

I know that if this error is overcome many butters now grading into second-class will grade well into first-class—a result that will be welcomed by "makers" of this class of butter.

Irrigation of Crops with Artesian Water at Moree Experiment Farm.

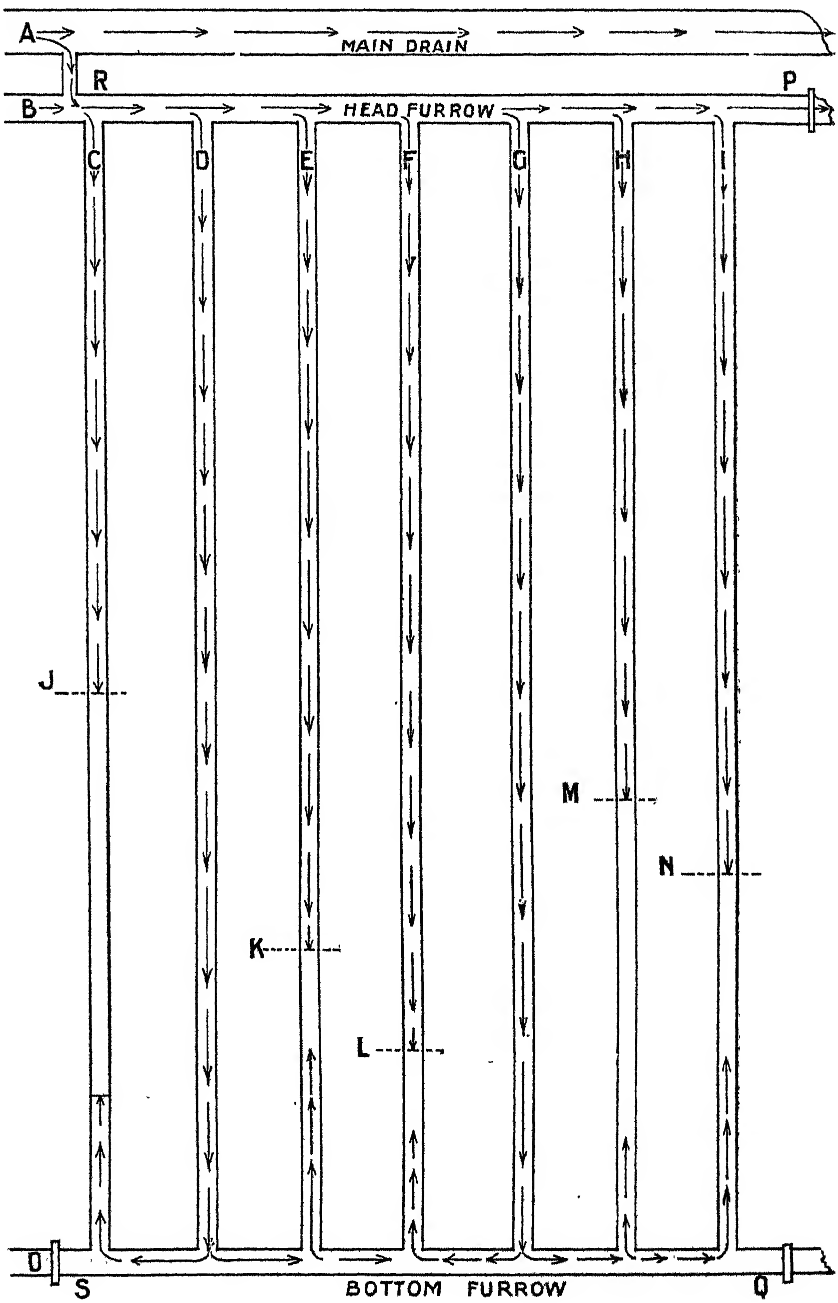
A. E. DARVALL.

FOR irrigation, the black clay soil of the North-western Plains, with its easy gradients, is ideal, and with a little care, forage and grain crops can be grown to perfection in the driest seasons. The stiffness of the soil obviates the necessity of putting in cement or wooden distributing ditches, which are always an expensive item, both as regards the initial cost and their maintenance afterwards. The irrigation furrows do not require constant watching to prevent them from breaking as they do in the lighter soils; and the habit the clay has of cracking as it dries makes it easy to irrigate crops such as wheat and oats when they are too high to allow a man to get in amongst them, the cracks leading the water naturally to the driest places and to the roots of the plants where it is most required.

As regards the quantity of water required to irrigate a certain area, this depends so much upon the nature of the crop, the season of the year, the rainfall, and the man who is irrigating, that it is very difficult to give a correct estimate. Some crops require much more moisture than others; in the summer the evaporation is much greater than in the winter. For instance, the average monthly evaporation at Bourke—to take an extreme instance—for July is 1·875 inches, whilst for January it is 8·892 inches. Now, in crops like maize, sorghum, millet, &c., where sown in drills, much of this evaporation can be stopped by cultivation (scarifying); whereas with wheat and oats, nothing in that line can be done after they are 9 or 10 inches high. On the other hand, the latter have their growing period in the winter and spring, when the evaporation is not so great, whilst the former are not sown until September, when the warm weather starts. As regards the last factor, the man who is responsible for the irrigation, many people think that because they have water they must put it on the land, whether it is required or not, and they frequently kill or stunt their crops through too much kindness. The best plan is to watch your crop, and when the ordinary farmer would say, "A couple of inches of rain would do those oats good," put your water on. It must always be remembered that the roots of plants cannot do without air any more than they can do without moisture, and if you fill up the soil with water, it forces the air out of it.

In order to get a fairly approximate estimate of the amount of water required for this purpose, I give below the quantity of water used at this farm in six irrigations extending over a period of fourteen months, applied to paddocks sown with oats, maize, and lucerne, both for germinating

FIG. No. 1


A
MAIN DRAIN
R
P
B
HEAD FURROW
C
D
E
F
G
H
I
J
M
N
K
L
O
S
BOTTOM FURROW
Q

the seed when the surface was dry but the subsoil moist, and also when the crops were well up and the subsoil fairly dry. The water was measured by a Grant Mitchell water meter, tested and guaranteed correct before the experiment was commenced.

The result was:

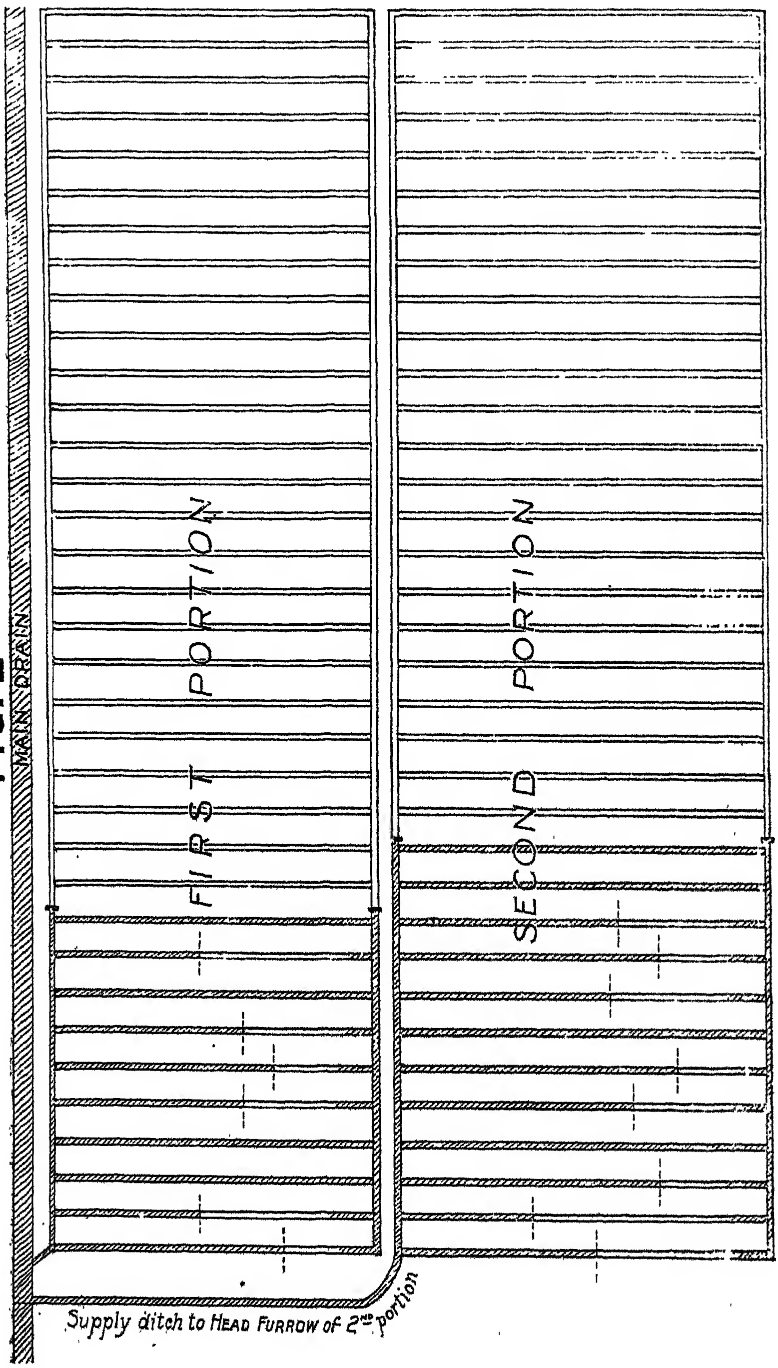
Area irrigated, 47 acres.
Water used, 702,630 cubic feet.
Time occupied, 475 hours.

Or, to reduce it to its simplest form, average quantity of water used per acre for one irrigation, 93,285·3 gallons, which is equal to a rainfall of 3·92 inches, and the time required to irrigate 1 acre = 10 hours. From this we find that if the whole flow of a bore giving 800,000 gallons per 24 hours is available, and the crops require an irrigation every six weeks, one ought to be able to keep 352·8 acres going; if every five weeks 284 acres; or in an exceptionally dry year, when the crops might have to have water once a month, 235·2 acres. Of course, figures are often very deceptive, and do not work out on the land as they do on paper; but if ever it is put to a practical test I do not think that this estimate will be very far out, always remembering that it is calculated for the black clay soil of this district. As a rule, it will be found that two irrigations plus the rainfall will be sufficient for grain, hay, and maize crops in ordinary seasons, but lucerne requires water after each cutting.

Now as regards the laying out of the paddock and application of the water, the simplest plan will be to describe the method employed on this farm, which so far has proved to be satisfactory. The land is ploughed some weeks before the crop has to go in, and having weathered down is harrowed; laths are then driven into the ground 8 feet apart—which is the width between the wheels of the drill—one way and 5 chains the other, to guide the ploughman who is to run the furrows. For this an ordinary wire clothes line about 200 feet in length, with pieces of rag inserted between the strands and fastened with binding wire at intervals of 8 feet, will prove very useful. It should have large rings or loops at the end, through which bars can be inserted to stretch it and keep it in position whilst the laths are being stuck in opposite each piece of rag. If there is a straight fence line to start from on one side of the paddock it is impossible to go far wrong, and two boys could do the work.

Having the land marked out, the ploughman runs the furrows with a shovel plough, which, having a double mould-board, throws the earth to each side of the furrow, and does better work than an ordinary plough. These furrows should not be deeper than is absolutely necessary, as the harvesting machinery has to be driven across them later on, and if they are very deep it is a very jolty business; also care must be taken that they are run in the same direction that the land was ploughed, otherwise the "clean-outs" will cross them and cause the water to break away. It is needless to say that this direction must be down the best gradient for irrigating. Here the fall in the land is 18 inches in 10 chains, which is an excellent gradient for the water to run down.

FIG. 2


MAIN DRAIN
FIRST PORTION
SECOND PORTION
Supply ditch to HEAD FURROW of 2ND portion

Having run all the irrigation furrows, the seed is drilled in, the wheels of the drill being kept in the furrows. As they will now be running below the level of the surface, care must be taken to set the hoes of the drill some 4 or 5 inches higher than if it was running over an ordinary surface, otherwise the seed will be set too deep.

The next and final operation is to run a deep furrow across the top of the irrigation furrows, by which the water will be led to them, and another across the bottom, the purpose of which will be explained later on. It is better to run these top and bottom furrows after the seed has been drilled in, otherwise they will be trampled in and broken by the horses when turning with the drill.

The paddock is now laid out as in Fig. 1.

Fig. 3.—Water backing up from bottom furrow.

On this farm the main drains, as will be seen in Fig. 1, run across the head of the paddock, and the head furrow B runs parallel to and about 6 feet from it; but this is immaterial so long as the water can be got to the head furrow. The water is let into the latter by a cutting in the bank. This is better than permanent pipes, which sometimes get the plugs knocked out of them or loosened, and give an involuntary irrigation when it may not be required. This cutting will supply from 20 to 30 furrows, according to the fall of the land, but as a rule 8 to 10 are opened at one time, temporary dams being made in the head furrow, as at P. This, however, depends entirely upon the amount of water available. If the whole of the flow of the bore could be used, over 70 furrows could be opened at the same time, water being supplied to the head furrow by cuts in the bank of the main drain at about 200-yard intervals.

The land not being absolutely level, it will be found that the water reaches the bottom of some furrows much sooner than in others. This is where the bottom furrow comes in. Looking at the plan (Fig. 1), it will be seen that in furrows D and G the water is right down, whilst in the others it has only reached J, K, L, and M respectively. Now, the water flowing from D and G, which would otherwise be wasted and swamp the land or road below the paddock, fills the bottom furrow, and is then forced back up those furrows that are not yet down; and if there is not a great fall in the land, will be backed up them for over a chain. (See Fig. 3.) Temporary dams must of course be placed in the bottom furrow, as at S and Q, confining the water to the section that is being irrigated. The banks of this furrow must be carefully made up with a shovel before the water reaches it, as it has to stand a considerable pressure of water.

Fig. 4.—Main drain and head furrow.
Note the unchanged appearance of the surface of the paddock, all of which, as seen in the photograph, has been irrigated.

The man who is to irrigate the paddock commences immediately the head furrow is run by the ploughman. With a shovel he opens the first ten irrigation furrows into the head one, and makes up their banks where broken by the horses. He also cleans out the head furrow if necessary, and dams it just below the last furrow to be irrigated. This being done, he makes a cutting into the main drain, lets the water in, and the irrigation has commenced. The next thing to do is to attend to the bottom end of the furrows where they lead into the bottom furrow; in fact, exactly the same work that has been done at the top. His work is then practically nil for the next few hours, as it will take the water five or six hours to run 10 chains.

Fig. 5.—Lucerne irrigated.

The best plan is for him to go ahead clearing up and connecting the head, bottom, and irrigation furrows, occasionally having a look to see how the water is running in the portion being irrigated. *He must on no account stand and help the water down the furrows by removing clods and inequalities.* These back up the water and help it to spread laterally, and no obstruction should be moved from the furrows unless it is so great as to cause the water to back up over the top of the banks. If the water has a clear run down a furrow it will simply puddle it, and will not soak into the soil.

As the water reaches to within a few yards of the bottom of each furrow, the top of it is dammed with a spadeful of earth. This will give that much

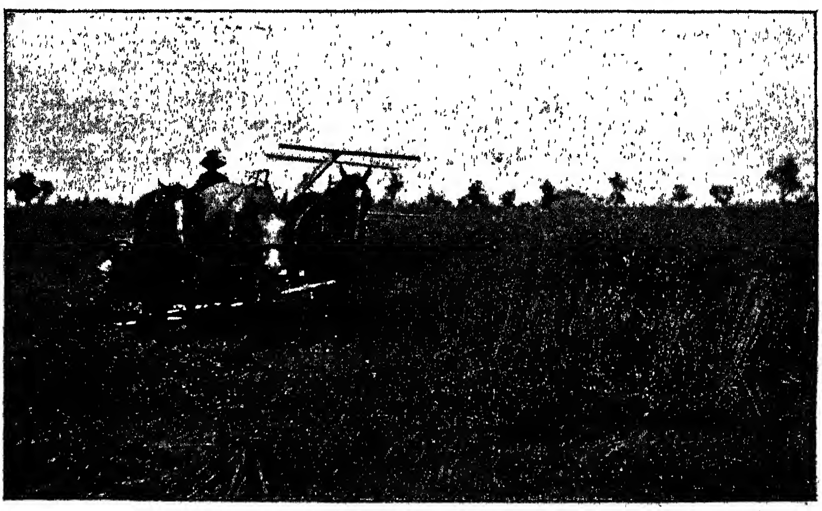


Fig. 6.—Algerian oats, irrigated.

extra water to those furrows that seem disinclined to run; but after a certain number have been stopped it will be necessary to open a few fresh ones, otherwise the banks of the head furrow will break. At night, provided there is no one to watch the water, about twelve furrows should be opened, and the flow reduced a little; also an extra half-dozen furrows should be opened into the bottom furrow beyond the last of the furrows that have been opened at the top. This gives the water a better chance to get away if it reaches the bottom of too many furrows before the morning. After the second day's irrigating, or later if it is a large paddock, the man will have got all the furrows ready for irrigating, and if there is a job to be done in a neighbouring paddock he can be put on to do it, just having a look at the water every now and then.

The irrigation of crops that are well up, say, 2 or 3 feet high, is simple. The top and bottom furrows having been cleaned of weeds, &c., the water is turned in as before. It will be noticed that the bottoms of the irrigation furrows have a crack right along them, and from these cracks others run laterally. These, as before mentioned, lead the water to the roots of the plants, and it will only require a man to attend to it for an hour or so in the morning, at noon, and at night, just before leaving off work.

This soil should never be irrigated by flooding, as this only puddles the surface, which afterwards dries and cracks off in big flakes. Moreover, any slight depression in the ground is left with water standing in it, which will scald and kill or stunt the crops growing there. Land that is to be irrigated by flooding has to be levelled first, which is a very difficult and expensive business, and involves an outlay that most farmers are unable to afford. By using the furrows, which are some 4½ to 5 inches deep, and can be made deeper if running through a rise, a difference of 2 or 3 inches in the level of the ground is immaterial. Besides, the surface of the paddock is left in practically the same condition as it was before the irrigation; so much so that sometimes, when treading on what appears to be a dry piece of ground, one sinks in over the tops of the boots. Looking across a well-irrigated paddock, one should not be able to tell that it has been irrigated, except that the soil has a slightly darker appearance. (See Fig. 4.)

If the paddock is a large one, and over 10 chains or so in length, it will be as well to divide it into two or more sections (Fig. 2), the head furrow of each section being supplied by a side drain. If this is not done, the crops at the top end will get too much water, and will lodge. Water can also be supplied to it from the bottom furrow of the first section, some of the furrows of which will be left running longer than they otherwise would be, but these only at wide intervals.

The same method of irrigation should be applied to orchards, three furrows being run between the rows of trees, the two side ones as near as the team can walk without damaging the branches, the third one in the middle.

Irrigation cannot be taught by books; only the broad principles can be laid down; the rest can only be learnt by experience. If possible, only intelligent, painstaking men should be selected for the job. If they do not take an interest in the work they are worse than useless, simply wasting time, water, and crops.

Worm Nests in Cattle due to Filaria Gibsoni (*Sp. Nov.*).

Preliminary Report.

J. BURTON CLELAND, M.D., Ch.M. (Syd.), Principal Assistant Microbiologist, and
T. HARVEY JOHNSTON, M.A., B.Sc. (Syd.), Assistant Microbiologist, Bureau of Microbiology, Sydney.

The finding of "worm-nests" in the briskets of the carcases of Queensland cattle exported to London in a frozen state has recently attracted public attention. These nodules containing parasitic worms, which, as far as we are aware, have never been recorded in cattle in other parts of the world than Australia, have been known, under the name of "worm-nests," "worm kernels," and "Spiroptera nodules," to workers in the Commonwealth for at least the last eighteen years, the first written description of them and of the contained worms being one by Dr. Gibson, of Windsor, New South Wales, in the *Proceedings of the Intercolonial Medical Congress for* 1892. Dr. Gibson was apparently unable to obtain the heads and tails of the adults of the parasitic worms he described, and hence could not "place" the species. This paper was followed a year later by one by Dr. Barnard, and Mr. Park, M.R.C.V.S., in the *Transactions of the Australasian Association for the Advancement of Science*, 1893. They noted the resemblance of the worm to *Spiroptera reticulata* of the horse; and as they were unable to obtain the essential head and tail ends (with the exception of one doubtful head isolated from a caseous mass), apparently provisionally left it with this name, which, for similar reasons, has been handed down from investigator to investigator till to-day. Recently, by teasing many specimens of "worm-nests" and by the aids of pancreatic digestion and putrefactive processes, we have been enabled to extract both heads and tails of the adult parasites, and to show that it is a species which we believe is new to science.

The "worm-nests" themselves have, as seats of preference, the tissues of the brisket, being seen, or when small, felt, as rounded or irregular masses, projecting from the surface of the skinned carcass or embedded more or less superficially in the muscles. They easily shell out by incising the stretched tissues over them, and then appear as rounded, oval, or lobulated, often flattened masses, from the size of a large pea to 2 inches or more in diameter. In the interior is a small worm intricately coiled in a loose fibrous tissue. The parasite is enclosed in a thin fibrous capsule, which can be shelled out of a denser fibrous tissue surrounding it. This external capsule in young forms is thin, but in larger growths may be an inch or more in thickness, and very dense and hard. It consists of fibrous tissue with connective tissue

cells and many eosinophile leucocytes. The increase in size of the "worm-nests" is due almost entirely to the increasing thickness of the outer capsule.

The worm, though bearing a striking general resemblance to *Filaria* (*Spiroptera*) *reticulata*, yet, as the following account indicates, differs, notably in the tail of the male, from the brief descriptions of this worm available to us. The description of the new parasite is as follows:—

Body greatly elongated and coiled: its diameter is from 0·38 to 0·43 mm. in the female and 0·155 in the male: its surface possesses ornamentation similar to that in *Filaria reticulata*. Head not constricted from the rest of the body, its breadth being about 0·09 mm., this gradually increasing posteriorly; mouth round, terminal, and bounded by small lips; vulva situated close to the anterior end (about ·8 mm. distance) in a rather wide, shallow concavity; male aperture situated on a slight projection at 0·072 mm. distance from the posterior end. A pair of small papillæ are present just behind the male opening, and a pair at the extremity of the tail. There are two unequal spicules, being 0·14 and 0·047 mm. long respectively. The females are ovoviviparous and viviparous, the uterus containing free embryos and eggs containing embryos; the embryos are about 0·22 mm. long by 0·003 mm. wide, with a blunt rounded anterior end and a short pointed tail.

"Worm-nests" are of very frequent occurrence in Queensland and West Australian cattle, and, we are informed, are sometimes found in New South Wales animals. The nodules are removed by the butchers when dressing the carcass, and many thousands of animals, which in life contained one or more of them, have been eaten by the inhabitants of Australian cities, it is needless to say, without any ill-effects. Even were the "worm-nests" themselves deliberately eaten, no danger to human beings need be apprehended. From the health aspect, their presence in a carcass is of practically no significance; from the butcher's standpoint, they may be viewed as interfering merely with the general appearance of the affected part; and from the point of view of the general public, they may be looked on as pathological curiosities, interesting from having eluded thorough investigation for many years.

As we seem to be the first who have obtained those portions of the worms which are essential for the purposes of description, and as the worm appears to be a new species, we desire to name it *Filaria Gibsoni*, in honour of the admirable work done by its first investigator, Dr. Gibson, seventeen and a half years ago, and in recognition of his worth as a pathologist.

In conclusion, we would like to express our indebtedness to Mr. C. J. Vyner, Chief Veterinary Inspector of the Department of Public Health, New South Wales, for obtaining for us an abundance of fresh material, from amongst which we were able to extract the heads and tails referred to.

Artesian Water—Chalybeate Properties.

R. S. SYMMONDS, Chemist's Branch.

The value of the mineral resources in the water under the earth of our 364,000,000 acres of artesian area is incalculable; indeed, our artesian area may be regarded as The Great Australian Cornucopia.

During a visit to Coonamble, my attention was drawn to the unsightly reddish-brown colour of the artesian water from No. 2 bore, and the rusty deposit in the bore-drains. There can be little doubt that the cause of this discoloration is the presence of ferrous carbonate (carbonate of iron) in the water, which becomes brown when exposed to the air, and is deposited as a rusty sediment, consisting of ferric hydrate, formed by the action of the air on the carbonate. The water as it issues from the bore is perfectly clear and colourless; after standing exposed to the air, in a few hours it becomes very turbid and unsightly. (See Fig. 1.)

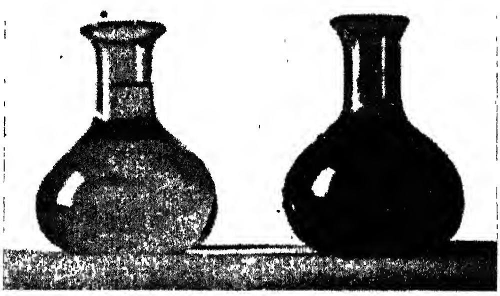


Fig. 1.

The carafe on the left contains bore-water as it appears when first drawn from the bore; the carafe on the right contains the same bore-water, and illustrates in a very striking manner the appearance of the water after standing exposed to the air. The photograph exaggerates the difference somewhat, owing to the rusty-red colour of the iron, which does not act on the photographic plate.

I am of the opinion that this water is really a chalybeate water, and possesses valuable medicinal properties equal, if not superior, to the celebrated chalybeate waters of Europe, and I shall be pleased if a complete analysis be made of the water from No. 2 bore, Coonamble, to enable me to compare it with such excellent chalybeate waters as Alet, Pougues, Pyrmont, Schwalbach, Pouhon, and others which are bottled and exported. These waters are recommended on account of their restorative properties in cases of debility consequent upon disease, or bodily or mental exertion for both sexes, and are useful in gastralgia, sluggish liver, anæmia, &c.

The source of the iron in the Coonamble bore-water opens up a very interesting problem. Is the iron naturally in the water, or is it the result of "local action" in the casing? I am inclined to the opinion that it comes from the casing, and put forward the following facts to support this view:—

(1) Fig. 2 illustrates the result of local action in casing. This length of casing was drawn from Coonamble bore No. 1 after it had been in use a few years. The water from this bore when exposed to the air deposits ferric hydrate.

(2) I have before me the remains of a length of casing from Warrana No. 3 bore, which went into solution in less than six months. The water from this bore deposited ferric hydrate along the drains while the casing was going into solution.

Fig. 2.

Fig. 3.

(3) A bore on Wingadee, where the casing is corroding badly, deposits iron along the drains.

(4) At Quambone No. 2 bore, where the casing is not corroding, the water does not deposit any iron when exposed to the air.

(5) Bundy bore, where the casing has been recently drawn and found to be perfectly sound, did not show any signs of oxidised iron in the drains.

The residents of Coonamble have already drunk and used many tons of casing dissolved from No. 1 bore, and look very well indeed on it; and it seems a pity that so much good casing should be wasted from No. 2 bore, as it would be a very simple matter to bottle the water in such a way that the iron would remain in solution. This water could possibly be sold as a chalybeate tonic, and thus be the means of contributing towards the cost of a new set of casing.

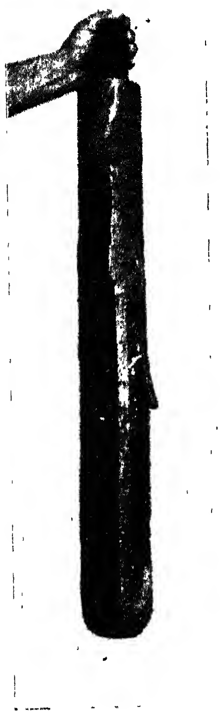


Fig. 4.

Fig. 3 shows some slotted lengths of casing drawn from the Bundy bore. These slots are cut by a very ingenious device, shown in Fig. 4. With this tool slots are cut in the casing at any desired depth from the surface, and when we consider that this tool operates in a 6-inch hole 2,000 or 3,000 feet below the surface, the result, as shown in the illustration, is extremely satisfactory.

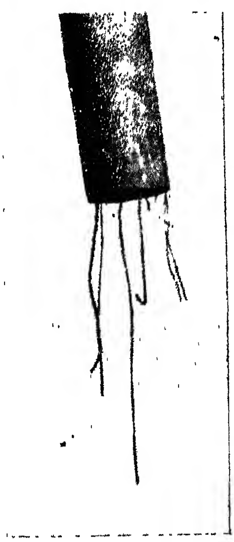


Fig. 5.

Fig. 5 is of interest, and probably shows the result of "local action" in casing. The pump, which works with a rotary movement inside the casing, became magnetised when working in a bore where the casing is going into solution. Pieces of iron wire can be seen attached to the end of the pump by magnetic influence.

Arsenate of Lead and Bordeaux Mixture.

In the *Gazette* for October, 1909, page 948, a paragraph quotes a report by the Chemist that the effect of mixing arsenate of lead and Bordeaux mixture would be to form sulphate of lead, which is a very insoluble lead salt. Mr. Guthrie wishes to add that the removal of the lead probably does not affect the poisonous action of the spray, though he cannot say definitely whether it does or not.

The "Farrer" Fund.

An Appeal to Australian Millers and Wheatgrowers.

The "Farrer" Fund, inaugurated with the object of creating some appropriate memorial to the late Mr. William Farrer, Wheat Experimentalist to the Department of Agriculture, has now reached £300.

The Committee appointed to control the Fund are anxious to invest the money permanently, so that the interest may go towards a bursary for some farmer's son or other lad showing special aptitude for experimental work with wheat, to enable him, first to study at one of the Farm Schools, and perfect himself, more especially in wheat-farming; then to proceed to the Hawkesbury College; and finally, it is hoped, to take advantage of the full course in agriculture at the University. A young man thus trained in practical and scientific work for seven years should be a very valuable man to the State, a worthy successor to Mr. Farrer, and an excellent assistant to the present Experimentalist, Mr. G. L. Sutton. But the amount already raised is insufficient to educate a lad through such a course of study, which would absorb £150 in fees, without taking into account the cost of board and lodging for a country lad while attending the University course for three years. In order to give a thorough training to one student every seven years, we need a capital sum of £700, which would ensure a worthy "William Farrer" scholarship or bursary.

The Committee, therefore, wish particularly to urge those who have promised subscriptions to send them in at once, in order that clerical labour may be saved, the Fund closed at an early date, the proceeds invested, and a student selected.

The Victorian Director of Agriculture has lately announced publicly that Federation, one of the Farrer wheats, has added £250,000 to the value of the last Victorian wheat harvest. May we not look to Victoria, and also to other States which have likewise benefited, for co-operation in our effort to honor a good man's memory?

All our millers recognise the superior milling value of a number of the Farrer wheats, in proof whereof a number of millers have already given a subscription when personally approached on the subject. Will not all the millers do likewise?

The Banks, Finance Associations, and many of the wheat-farmers have recognised the value of Farrer wheats, especially in the last wheat season. I appeal to every one financially interested, whether a corporation or an individual, to give a subscription to the Farrer Memorial Fund.

H. C. L. ANDERSON,
Under Secretary.

Department of Agriculture,
20th January, 1910.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Meerschaum Vale.	8 June, '10.
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Alstonville ...	28 Feb., '10.
,, ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
,, ..	Sir Jack ...	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
,, ..	Berry Melbourne	Melbourne ...	Rum Omelette	Berry Stud Farm .	†
Guernsey ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Alstonville ...	16 Feb., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	Casino	24 May, '10.
,, ..	Star Prince ...	Calm Prince ...	Vivid ...	Dunoon	3 July, '10.
,, ..	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
,,	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	....	†
Red Poll ...	The Judge ...	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A. College, Richmond	*
,, ...	Dado	Daniel	Dot	H.A. College, Richmond	*
Kerry	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ...	Glen Innes Farm...	†
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 2nd February, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

GUERNSEYS.—Lord Clatford: sired in England by Lord Clatford II, 1814; dam, Clatford Richesse, 6816 (imp.); calved 16th October, 1907; colour, lemon and white; price, £50. **Clatford Richesse is a fine type of dairy cow.**

Prince Illustrious: sire, Calm Prince; dam, Vivid II, from Vivid (imp.), **by Prince Moscow, by Rose Prince (imp.);** calved 8th March, 1909; colour, lemon and white; price, £40. **This is a great milking family, having the blood of Vivid and Calm, two great dairy cows.**

AYRSHIRE.—Scotland's Hope: sire, Jamie's Ayr; dam, Judica, **from Juliette, by Prince Emerald (imp.);** calved 21st February, 1908; colour, brown and white; price, £15.

JERSEYS.—Jack's Joy: sire, Sir Jack; dam, Rum Omelette II, **from Rum Omelette (imp.), by Golden Lord;** calved 4th June, 1908; colour, whole; price, £30.

Dreadnought: sire, Sir Jack; dam, Lady Kitchener, **from Egyptian Princess (imp.), by Lord Melbourne;** calved 22nd October, 1908; colour, whole; price, £20.

Calceolaria's Lad: calved 6th July, 1907; sire, Melbourne (imp.); dam, Calceolaria (imp.); colour, whole; price, £30.

DEXTER KERRY.—Mountain King: sire, Vesuvius; dam, Aicme Dear, **from Aicme Close (imp.), by Ham (imp.);** calved 10th March, 1909; colour, black; price, £8.

WOLLONGBAR EXPERIMENT FARM.

GUERNSEY.—Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909; price, £45.

HOLSTEINS.—Cronje: sire, Hollander; dam, Boswe; calved 4th February, 1909; price, £15.

Dutchman II: sire, Hollander; dam, President's Schot; calved 30th December, 1908; price, £10.

AYRSHIRE.—Glencoe: sire, Prince Royal; dam, Cheva; calved 14th August, 1908; price, £15.

Applications for the bulls at Wollongbar Experiment Farm will be held till 21st February. If more than one application be received for any one bull, his disposal will be decided by ballot.

The prices indicated are at the respective farms, or on rail at Berry or Lismore.

H. C. L. ANDERSON,
Under Secretary.

Orchard Notes.

W. J. ALLEN.

February.

The soaking rains which have fallen lately throughout most of our fruit-growing districts will have the effect of saving the apple, pear, and stone-fruit crops, as well as the lives of many an old orange and lemon tree. The advent of this rain was most opportune, as previous to that it was not an uncommon thing to see old trees wilted and suffering from want of moisture—this, too, in places where the cultivation had not been neglected. The counties of Camden and Cumberland have passed through years of drought—1909 being the driest of dry seasons—consequently there was little if any moisture in the subsoil, and as soon as the hot weather set in the trees showed signs of distress. However, they are now looking well wherever they are receiving proper attention. I trust that every grower had his cultivator to work, and the whole of the orchard well worked up in order to put the ground in a good state of tilth, and prevent evaporation.

Irrigation.

Many of our fruit-growers would have been happy if, during the dry season, they could have given the trees and crops a thorough irrigation. Some had made provision for such emergencies, and were able to give the trees water when it was necessary, whilst others, perhaps just as favourably situated, failed to avail themselves of the water, which was allowed to run to waste while their trees and crops were badly in need of it. We know that the majority of our growers would find it expensive, or perhaps almost impossible, to make proper provision for such dry times, but there are many on the other hand who, by the expenditure of a little capital and labour, could store sufficient water, either in creeks or dams, as would enable them to give their trees one or two good waterings, or sufficient to help them through such dry summers as those through which we have come of late.

In applying water to the land it should be well soaked to a good depth, and immediately the soil is dry enough, the cultivator should be at work, and the land stirred to a good depth by running the cultivator over at least twice after each irrigation.

Trees or vines which have not had an application for some time will, in all probability, require one this month; but it is best to arrange to give currants, sultanas, and raisin grapes their last watering before harvesting the crop during the month of January if possible, as by so doing the ripening will not be retarded as by later applications.

Budding.

If trees are in good condition, the first week in this month is the best time for reworking worthless varieties. It will be found that the bud can be inserted more easily underneath than above the limb, and when the buds shoot forth next season, the result will be a nice open centre, and a well-shaped tree. Choose buds from some of the best bearing trees, as only the best is good enough.

Export of Apples.

In last month's *Gazette* instruction in the packing of apples for export was given. See that only the best fruit is sent away—that it is neither too green nor too ripe—well classed as to colour and size, and that the wrapping, packing, and stencilling are done in the neatest possible manner, so that when the fruit is opened up for sale in Great Britain it will compare favourably with the fruit from any other State or country. In handling it see that it is kept as cool as possible, and use every care to prevent bruising. Use good, strong, clean, new cases for holding the fruit, and have them neatly and legibly stencilled.

Scales on Citrus Trees.

If trees are weak and out of condition, it is best to defer spraying and fumigating until next month, or, at any rate, until after sufficient rain has fallen to bring them back to normal condition, and it will be found that trees fumigated in March will have time to throw off the scale before the fruit is ready to be marketed.

San José Scale.

Deciduous trees infested with San José scale may be sprayed with the resin, soda, and fish oil as soon as the crop is harvested—the sooner now the better.

Codlin Moth.

Continue to fight this—the greatest enemy of the apple-grower—as it is only by united action on the part of apple, pear, and quince growers that we may ever expect to conquer it. Those who have sprayed with arsenate of lead (Swift's) or arsenate of soda, two or more times, and attended to the bandages regularly, report a light percentage of damaged fruit. We still, however, have a number of careless and neglectful growers, who are a menace to their neighbours, and who, by a neglect of these precautions, give our inspectors considerable worry. A good many of these neglected orchards are being weeded out; but there are still scattered orchards which, if they do not receive more systematic attention from the owners or occupiers, will have to be uprooted, as it is the intention of the Department to help the growers in every way possible to fight, and, we hope, to practically wipe out this pest; but this cannot be accomplished while we have growers who bury their infested fruit, or fail to comply with the regulations under the Act. We hope, therefore, that not only will the fruit-growers' unions do all they can to see that every grower does his duty, but that the growers themselves will, when they know of negligence in their neighbourhood, either notify the Department or the local inspector.

Fruit Fly.

The absence of this pest from our orchards this year has made the life of the fruit-grower very much easier, and the neighbouring States need have very little fear of introducing this pest with any fruit which they may import from this State, as the fly has practically disappeared. In order to prevent its reappearance, however, our growers must continue the work of picking up and destroying (by boiling or burning) of all fallen or infested fruit. If this precaution is strictly carried out, I do not anticipate much more trouble from this unpopular visitant.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.		Date.
Wollongong A., H., and I. Association	F. W. Phillpotts	Feb.	3, 4, 5
Shoalhaven A. and H. Association, Nowra	Henry C. Rauch	,,	9, 10
Central Cumberland A. and H. Association	H. A. Best	,,	16, 17
Coramba District P., A., and H. Society	H. E. Hindmarsh	,,	16, 17
Moruya A. and P. Society	P. Flynn	,,	16, 17
Alstonville A. Society	W. Monaghan	,,	16, 17, 18
Kangaroo Valley A. and H. Association	E. G. Williams	,,	17, 18
Queanbeyan P. and A. Association	E. C. Hincksman	,,	17, 18
Guyra P., A., and H. Association	P. N. Stevenson	,,	22, 23
Tumut A. and P. Society	E. H. Vyner	,,	23, 24
Manning River A. and H. Association	S. Whitbread	,,	23, 24
Ulladulla A. Association	J. Boag	,,	23, 24
Bellinger River A. Association	S. S. Hindmarsh	,,	23, 24, 25
Gunning P., A., and I. Society	W. T. Plumb	,,	24, 25
Robertson A. and H. Society	R. G. Ferguson	,,	24, 25
Wyong Agricultural Association	Edgar J. Johns	,,	25, 26
Albion Park A., H., and I. Association	Hector G. Fraser	Mar.	1, 2
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskins	,,	1 to 5
Narrabri P. and A. Association	W. H. Ross	,,	1, 2, 3
Tamworth A. Association	J. R. Wood	,,	1, 2, 3
Yass P. and A. Association	Will Thompson	,,	2, 3
Braidwood P., A., and H. Association	L. Chapman	,,	2, 3
Coraki A. and H. Society	D. Cameron	,,	2, 3
Bega A., P., and H. Society	W. A. Züegel	,,	2, 3, 4
Nepean District (Penrith) A., H., and I. Society	Percy J. Smith	,,	3, 4
Berrima District A., H., and I. Society	....	,,	3, 4, 5
Molong Agricultural Society	A. D. Millar	,,	8
Bombala Exhibition Society	W. G. Tweedie	,,	8, 9
Murrumburrah P., A., and I. Association	J. A. Foley	,,	8, 9
Bangalow A. and I. Society	W. H. Reading	,,	8, 9, 10
Central New England P. and A. Association (Glen Innes), National Show.	Geo. A. Priest	,,	8 to 11
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	,,	9, 10
Quirindi District P., A., and H. Association	W. Hungerford	,,	9, 10
Campbelltown A. Association	Fred. Sheather	,,	9, 10
Berry Agricultural Association	C. W. Osborne	,,	9, 10, 11
Mudgee Agricultural Society	H. Lamerton	,,	9, 10, 11
Warialda P. and A. Association	A. J. Devine	,,	9, 10, 11
Crookwell A., P., and H. Association	M. P. Levy	,,	10, 11
Port Macquarie and Hastings District A. and H. Soc.	W. R. Stacy	,,	10, 11
Oberon A. and P. Society	W. Minehan	,,	10, 11
Newcastle A., H., and I. Association	C. W. Donnelly	,,	10, 11, 12
Cobargo A., P., and H. Society	T. Kennelly	,,	11, 12
Dapto A. and H. Society	G. A. McPhail	,,	15, 16
Blayney A. and P. Association	E. J. Dann	,,	15, 16

Society.	Secretary.	Date.
Cooma P. and A. Association	C. J. Walmsley ...	Mar. 15, 16
Inverell P. and A. Association	J. McIlveen ...	,, 15, 16, 17
Armidale and New England P., A., and H. Association (Armidale).	A. McArthur ...	,, 15, 16, 17, 18
Gloucester A. Society	E. Rye	,, 16, 17
Coonabarabran P. and A. Association...	Geo. B. McEwen	,, 16, 17
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 16, 17, 18
Camden A., H., and I. Society...	C. A. Thompson...	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 17, 18, 19
Royal Agricultural Society, Royal Agricultural Show	H. M. Somer ...	,, 22 to 30
Southern New England P. and A. Association (Uralla)	W. C. McCrossin..	,, 22, 23
Kyogle P., A., and H. Society	P. C. Beer ...	,, 23, 24
Taralga A., P., and H. Association	C. Ross	,, 31, April 1
Nambucca A. and H. Association	R. Turnbull ...	,, 31, April 1, 2
Gundagai P. and A. Society	A. Elworthy ...	April 5, 6
Walcha P. and A. Association	J. New Campbell..	,, 5, 6
Adaminaby P. and A. Association	W. Delaney ..	,, 6, 7
Bathurst A., H., and P. Association	A. H. Newsham...	,, 6, 7, 8
Bowra A. Association	C. Moseley ...	,, 7, 8
Moree P. and A. Society...	D. E. Kirkby ...	,, 12, 13, 14
Richmond River (Casino) A., H., and P. Society ...	W. S. Rayner ...	,, 13, 14
Orange A. and P. Association	W. Tanner ...	,, 13, 14, 15
Upper Manning A. and H. Association (Wingham)...	D. Stewart, jun....	,, 14, 15
Luddenham A. and H. Society	W. Booth ...	,, 14, 15
Corowa P., A., and H. Society...	J. D. Fraser ...	,, 16, 17
Narrabri P., A., and H. Association	W. Malane ...	,, 19, 20, 21
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	,, 19, 20, 21
Wellington P., A., and H. Society	A. E. Rotton ...	,, 20, 21
Clarence P. and A. Society	T. T. Bawden ...	,, 20, 21, 22
Macleay A., H., and I. Association (Kempsey) ...	E. Weeks... ...	,, 20, 21, 22
Lower Clarence A. Society (Maclean)	F. W. Collison ...	,, 26, 27
Dubbo P., A., and H. Association	F. Weston ...	,, 27, 28
Durham A. and H. Association...	Chas. E. Grant ...	,, 27, 28
Nyngan and District P. and A. Association	R. H. A. Lyne ...	May 18, 19
Deniliquin P. and A. Society	L. Harrison ...	July 21, 22
Hay P. and A. Association	G. S. Camden ...	,, 26, 27
Murrumbidgee P. and A. Association	A. F. D. White ...	Aug. 23, 24, 25
Junee P., A., and I. Association	T. C. Humphrys...	,, 31, Sept. 1
Young P. and A. Association	G. S. Whiteman...	Sept. 6, 7, 8
Germanton P., A., and H. Society	J. S. Stewart ...	,, 8, 9
Ganmain A. and P. Association	J. H. Ashwood ...	,, 14
Temora P., A., H., and I. Association...	John Clark ...	,, 20, 21, 22

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Agricultural Gazette of New South Wales.

Varieties of Wheat Recommended by the Department of Agriculture.

GEO. L. SUTTON, Wheat Experimentalist.

IN the *Agricultural Gazette* for last month lists were given of the varieties of wheat which the Department of Agriculture recommended for cultivation during the year 1910, together with the period of planting and the class of wheat district for which each variety is suitable. Farmers will note that the names of several old and familiar varieties have been omitted. This may occasion some surprise, as some of those varieties have proved consistent yielders in various parts of the State. Because of this latter fact, some may think that these varieties and their merits have been overlooked, but such is not the case. The merits of any wheat, known to be in general cultivation, were carefully considered, and no wheat was removed from the list until the reports available, and the experience and observation of the officers present, proved that it could be replaced by another variety of equal, if not superior, yielding capacity, and which was, at the same time, better in some other respect. Nor has any variety been included in the list unless trials with it have shown that it has been consistently prolific. It was recognised that the first and, indeed, the essential requirement of a farmer's variety is ability to yield well and consistently. Unless it was known to possess this ability, no variety, however valuable in other respects, was included in the list of varieties recommended.

Most of the old varieties not included in the published list were rejected because of inferior milling value. At first sight this may seem an insufficient reason for rejecting a variety, but the following instance, of several similar ones, will convince any thinking man to the contrary. A southern miller found himself with 2,000 bags of flour which, because of its low strength, was unsaleable. This flour had been milled from a certain variety of wheat which was largely grown in the district, and which yielded well. Though the flour was eventually disposed of, after blending it with flour from a better, *i.e.* "stronger," variety, the miller advertised that, in the future, he would refuse to buy grain of the variety referred to.

It is evident, from this and other similar cases, that certain varieties of wheat do not satisfy the requirements of the present-day millers. Because of this, whenever it has been possible to replace one of these varieties with another of equal yielding capacity, but of superior milling quality, this has been done, and in consequence several old familiar varieties have been omitted from the list of those recommended. The Department, as the friend and adviser of the farmer, could not do otherwise.

A "standard of strength" has been fixed, to which the varieties recommended by the Department for *grain* production must reach. The standard is such as to include all the varieties which trial and experience have proved to be the most prolific. The standard determined upon is that of 47 (new estimation). This means that a 200-lb. sack of flour, when made into dough, shall have absorbed 47 quarts of water, and that in consequence 282 lb. of light nutritious bread can be produced from it.

Three of the varieties recommended, viz., Zealand, Steinwedel, and Thew, do not reach this standard, but they are included for the following special reasons. Zealand is the standard hay variety of the Riverina district; Steinwedel has proved a consistently good hay variety at Coolabah and other dry districts outside the recognised wheat belt; and Thew has proved one of the most suitable for hay in the coastal districts. These varieties are included because sufficient evidence is not yet available to prove that they can be profitably replaced by varieties equally as valuable in their respective spheres, and at the same time of better milling value.

Classification.

The varieties recommended may be classified as follows:—

Early Varieties.—Bobs, Bunyip, Comeback, Cedar, Federation, Firbank, Steinwedel, Thew, Bayah, Florence, Nutcut.

Mid-season Varieties.—Rymer, Uppercut, Warren, Cleveland, John Brown, Jonathan, Huguenot.

Late Varieties.—Haynes' Blue Stem, Jumbuck, Marshall's No. 3, Medeah, Genoa, Yandilla King.

Varieties suitable for very dry and hot districts.—(1) For early and mid-season planting: Jumbuck, John Brown, Steinwedel. (2) For mid-season and late planting: Bobs, Firbank, Bunyip.

Varieties suitable for dry and hot districts.—(1) For early and mid-season planting: Zealand, Marshall's No. 3, Rymer. (2) For mid-season and late planting: Federation, Bunyip, Firbank.

Varieties suitable for medium dry and hot districts.—(1) For early and mid-season planting: Jumbuck, Marshall's No. 3. (2) For mid-season and late planting: Bobs, Federation, Bunyip, Comeback, and Firbank.

Varieties suitable for cool districts.—(1) For early and mid-season planting: Cleveland, Jonathan, and Haynes' Blue Stem. (2) For mid-season and late planting: Bobs, Cedar, Federation, and Comeback.

Varieties suitable for the coastal districts, or those subject to rust.—John Brown, Marshall's No. 3, Medeah, Thew, and Uppercut.

The following particulars of the different varieties are likely to prove of interest to those connected with the wheat industry, and useful to growers desirous of selecting varieties for their particular needs and conditions.

Bobs.

Bobs is rather a tall, erect, compact growing variety, which stools moderately. The foliage is erect, dark-coloured, but not plentiful. The straw,

when ripe, is white. It is hollow, and in good seasons likely to be weak. The ears are creamy white in colour, bald, without tip-beard, of good size, fairly long, and slightly tapering, with open, rather than compact spikelets. The grain is small and plump, weighing remarkably well, with a good bright skin and horny interior. Though it is rather harder and more difficult to grind than the soft wheats, it is liked by millers because of the large percentage of high-class flour, and small percentage of thin bran it produces. As a milling variety, it belongs to the New South Wales Strong White class, and is admirably suited for blending with weaker kinds.

Its defects are: It is bunt and rust liable, and if sown early is susceptible to frosting. It is subject to attacks of aphis, which cause it to be laid. It also has a slight tendency to shell.

In South Africa it is known as "The Darling Wheat."

Bobs was produced in 1896 as the result of mating a variety of barley called Nepaul, or Bald Skinless Barley, with a strain of Blount's Lambrigg wheat, which, for record purposes, was called M. (F.), but which became known later as Early Lambrigg. As the result of the artificial pollination effected, only one shrivelled grain was produced. This was planted, and very little difficulty was experienced in fixing a variety from it. Four years later the progeny of this cross had become fixed, and was named Bobs.

This variety is really a hybrid, and not a cross-bred, for it is the result of mating two *distinct* species, viz., a *wheat* and a *barley*, together. A cross-bred is the result of mating two varieties of the *same* species together.

When the new variety was introduced, and it became known that it was the result of a union between a wheat and a barley, fears were expressed by some that it would not prove stable, but would exhibit considerable variation, and possibly would revert to the barley type. These fears have proved to be entirely unnecessary and unfounded. Bobs has been found to exhibit no more variation than any of the old familiar varieties. Some cases of variation and one or two cases of supposed reversion were reported; these were investigated and were found to be the result of admixture with foreign grains. In the cases of alleged reversion reported, the barley found growing amongst the Bobs was the variety Cape, which is bearded, and to which Bobs is in no way related.

Bobs is an early variety, and in many districts has proved a very satisfactory yielder. At Piper's Flat it produced 40 bushels per acre, which, up to that time, was a record for the district. It prefers a moderately cool climate to a very hot one, though extremely satisfactory returns have been obtained in the dry climates of Coolabah and Condobolin. It is a good general purpose variety. It produces heavy crops of excellent hay, sweet, of good colour, and of which stock are very fond. Stock are also said to be very fond of the thrashed straw.

It was the first Farrer wheat to be commercially successful, and is probably, with perhaps the exception of Federation, the very best known of those wheats. Its introduction into general cultivation was at once the late

William Farrer's triumph, and an ample justification for the views advanced by him before the Australian Association for the Advancement of Science in 1898, when such views were regarded by the majority of people as being those only of a visionary. Its successful and profitable cultivation proved beyond doubt that the climate of the wheat areas of Australia was suitable for the production of varieties from which "Strong," as well as "White," flour could be milled.

At one time no wheat was so prominently before the farming public as Bobs, and probably no wheat has had so many contradictory reports circulated about it. This is not surprising considering the great attention given to the variety when it was first introduced. There was then a great demand for seed of this variety, so great that it could not be met, and some instances are recorded where seed of other varieties was sold as Bobs. It is, therefore, not surprising that, when two or more varieties were being grown under the one name of Bobs, considerable variations in its characteristics should be reported.

On its introduction into general cultivation, the initial reports indicated that Farrer's ideal of a rust-proof variety were about to be realised. Many of the first crops were reported as being entirely free from rust, though, in some instances, they were growing alongside of or amidst varieties severely damaged or entirely ruined by the pest. Subsequent trials have, however, shown that the hope then raised was a false one, and that the variety is one very liable to rust.

Much was expected of the new variety, and many claims were made for it which were never put forward nor endorsed by its originator. All that he ever claimed was, that it was likely to suit some of the wheat districts as well as the varieties then being grown in them, and that, where it suited, it would profitably produce a flour of better milling value, and, therefore, of more economic value than the varieties in general cultivation. These claims have been proved up to the hilt. The experience of our millers and exporters conclusively shows that this variety is of excellent milling value. This has been further corroborated by the independent testimony of Mr. A. E. Humphries, a recognised European authority, and who, as president of The National Association of British and Irish Millers, conducted a comparative trial of Bobs and other flours. His report of this trial was to the effect that the Bobs flour was the best Australian flour which he had ever handled, and that it made as many loaves as Manitoba flour, but that the loaves were not quite as large.

Further evidence in this direction is afforded by the fact that for several years past it has been placed as the Champion Milling Wheat of New South Wales, at the Royal Agricultural Show, Sydney. It has gained this proud position by sheer merit, winning it as the result of actual milling trials between the varieties competing. There are indications that it will have to relinquish this position to newer varieties, but it can do so with honour. It has had a record of which Australia and the memory of its originator may be justly proud.

Fig. 1.—Bobs.

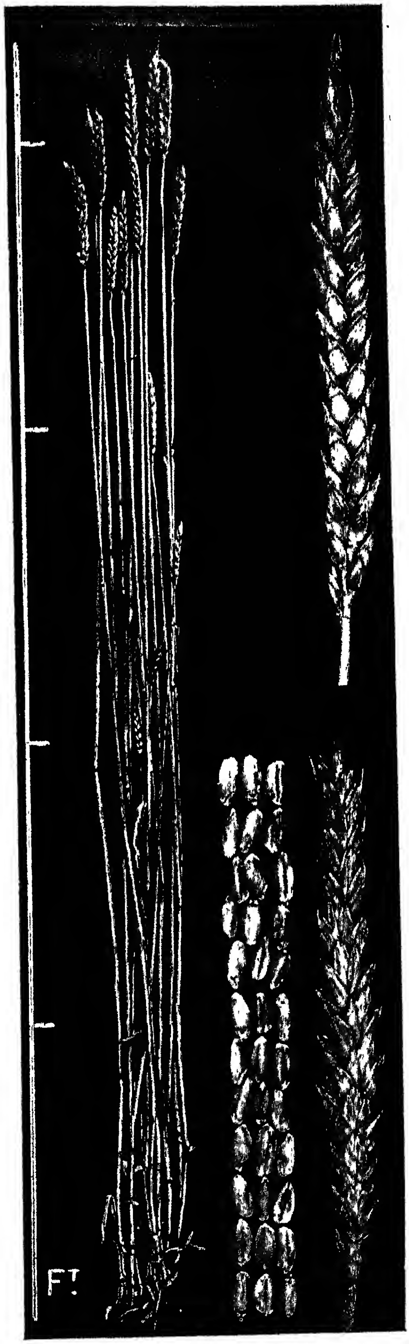


Fig. 2.—Bunyip.

Varieties of wheat recommended by the Department of Agriculture.

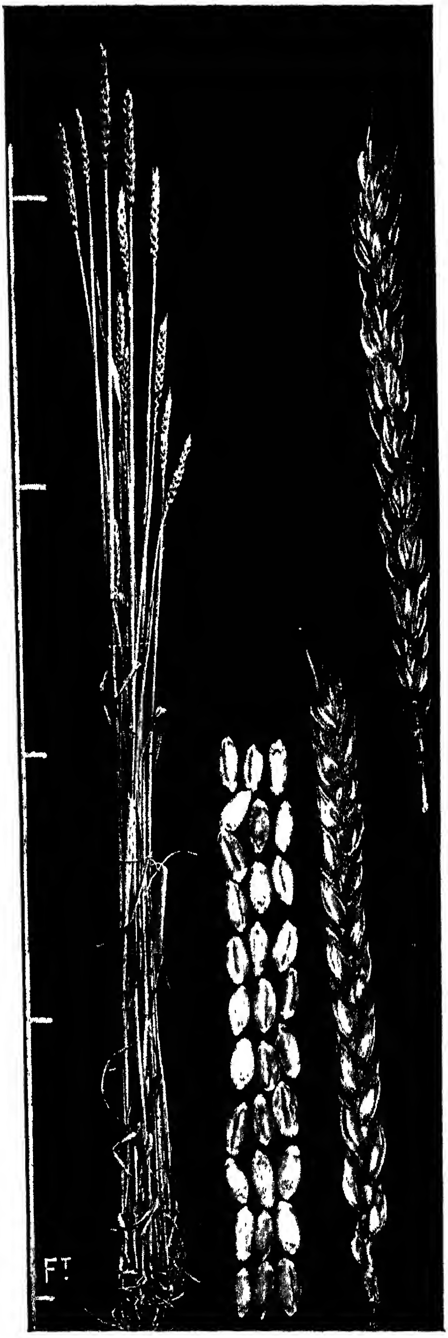


Fig. 3.—Cleveland.

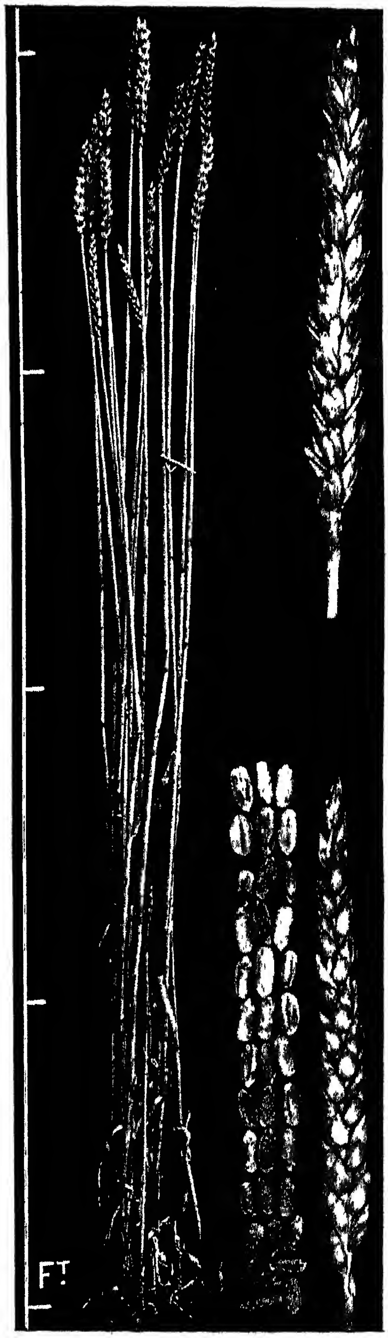


Fig. 4.—Comeback.

Varieties of wheat recommended by the Department of Agriculture.

Bunyip.

Bunyip is rather an erect, compact, and strong growing variety, which stools fairly well, and is of medium height. The foliage is fairly broad, inclined to be limp, and of good colour, though on the light side. The straw is yellowish and fairly stout. The ears are good, stout, well-tipped, with slight tip beards. The grain is large, plump, attractive, and yellowish white in appearance.

It is a cross-bred, produced as the result of mating two other cross-breds, Rymer and Maffra, together. Rymer, the mother plant, was produced as the result of crossing Purple Straw on to Improved Fife, the latter being a Manitoba variety. Maffra was the product of King's Jubilee, mated with an unnamed cross-bred (Blount's. Lambrigg x Hornblende). Its pedigree is, therefore, as follows :—

Blount's Lambrigg × Hornblende

An unnamed cross-bred × King's Jubilee

Improved Fife × Purple Straw.

Rymer × Maffra

Bunyip

The cross was made in 1897, and named in 1901.

It is a very early variety, in some instances proving a fortnight earlier than Steinwedel. Because of this extreme earliness it should not be sown early in the season; to do so is to court failure, unless precautions are taken to eat it off, or the spring proves a dry one. If sown too early it is apt to grow rather tall, and the straw to become weak. It is advisable to sow it after the middle of the planting season rather than before.

Under normal conditions the straw is on the short side, and on that account this variety is not very suitable for hay, though satisfactory results in this direction have been reported. This variety is bunt and rust liable, but is early enough to escape rust in most years.

It suits the dry, warm districts, yielding a heavy crop of large, bright, even-sized, plump grain. When ripening, the crop presents a very level headed and attractive appearance.

Cleveland.

Cleveland is a vigorous, rather tall-growing variety. It stools abundantly, and in its young state has rather a spreading habit. The foliage is fairly abundant, and of a good dark green colour; the leaves are narrow, erect, and rather stiff. The straw is white, and on the stout side The ears are of medium size, and slightly tapering, with white, smooth chaff. The grain is of medium size, white and plump.

This variety is a cross-bred, produced by mating Hornblende with Blount's Lambrigg, and then crossing Purple Straw Tuscan on to the progeny. Its pedigree is therefore :—

Hornblende × Blount's Lambrigg

Unnamed × Purple Straw Tuscan

Cleveland

Cleveland is a late variety, and for this reason is more particularly suitable for planting early rather than late in the season. It is a good general purpose variety, being equally suited for hay as for grain. It prefers a cool climate. At the Bathurst Experiment Farm it has proved the best variety yet grown. Mr. Peacock, the manager, thinks that it could, with advantage, replace Dart's Imperial in districts where the latter variety is popular.

It is rather a good rust resister, and is not very susceptible to bunt.

As a milling variety it is in the "Soft White" class.

Comeback.

Comeback is a rapid growing variety of medium height, which stools rather sparsely. When young, its growth is inclined to be compact and fairly erect. The colour of the foliage is on the pale side, and the flag is scanty, short, and fine. The straw is white, slender, slightly weak, but elastic. The ears are of medium size, bald, and tapering. The chaff is smooth, white, and fairly close. The grain is small, hard, plump, and bright, with the contents of a horny character.

Comeback is a cross-bred, produced as follows:—Improved Fife as a mother plant was mated with an unnamed cross-bred, obtained by crossing Vanessa with an Indian wheat called "G." Vanessa was a cross-bred produced by mating Hornblende (a Fife variety) with another Indian variety called "A," the latter being the sire.

Its pedigree is, therefore:—

Hornblende × Indian "A"
Vanessa × Indian "G"
Improved Fife × Unnamed
Comeback

As the mother of this variety was a Fife, and its sire a cross-bred of Indian and Fife parentage, the fitness of calling this variety Comeback, because of its origin, is apparent.

As the result of a clerical error, the pedigree of this variety was at one time reported to be "M(F)" x Pasteur.

So far, this variety has been more extensively grown in South Australia than in New South Wales. In the sister State there were cultivated several strains of the original cross. The best of these is now recognised to be Pratt's Comeback, which received that name in the following manner:— Several strains of the cross were sent by Mr. Farrer to Mr. Pratt, of Two Wells, South Australia. On growing these, it was found that there were considerable differences between them. Mr. Pratt selected the best of these, and afterwards sold the seed of them. The seed sold by Mr. Pratt was given the distinctive title of Pratt's Comeback, in order to distinguish it from other strains of the same variety.

Comeback is a very early variety, flourishing best under medium dry conditions. It should not be sown early—not earlier than the middle of the

planting season. If sown too early it is apt to become frosted, and to grow too tall to stand up properly, unless the season happens to be a dry one.

It is early enough to escape rust in most seasons, and is also slightly rust resistant. It is not particularly susceptible to bunt.

It is admirably suited for hay, the straw retaining its green colour until well on towards maturity. The ripe straw is particularly clean, bright, attractive, and well adapted for mixing purposes.

In districts where Federation is the main crop variety, Comeback is very suitable for completing the planting towards the end of the season.

As a milling variety it belongs to the "New South Wales Strong White" class. It is superior to Bobs, and is probably unexcelled by any variety in general cultivation in any part of the world. Mr. Kahlbaum, a leading miller of South Australia, has emphatically expressed the opinion that the flour from it is better than the best imported Manitoba.

Amongst millers and exporters there is a keen demand for this variety at the advanced rates of from 3d. to 6d. per bushel. Farmers who grow this and other varieties of the same class should, for commercial reasons, keep them separate, and make a distinct class of them. It is not a good business policy to mix them with other varieties of the Soft White class in order to make a sample of the F.A.Q. standard.

Federation.

Federation is a short, strong, erect-growing variety, which does not stool very abundantly. The foliage of the young plant is of good colour, with fairly broad, stiff leaves. The straw of the ripe plant is yellowish white, stout, and short. The ears are bald, of medium to large size, full tipped, uniform, and compact, with the spikelets set rather closely. The chaff is red-amber coloured, smooth, and fairly close. The grain is of medium size, white, soft, and plumpish.

Federation is the result of a cross between a strain of Purple Straw and Yandilla. The latter was produced by crossing Improved Fife with an Indian variety called Etawah. Its pedigree is:—

Improved Fife × Etawah

Purple Straw × Yandilla

Federation

This variety is the most popular farmers' variety in New South Wales at the present time. It has reached this position because of its remarkable ability to yield well and consistently throughout the whole of the wheat areas not only of New South Wales, but also of Victoria and South Australia. In some districts it is estimated that it yields at least a bag more per acre than any of the old varieties. The following instance will show the remarkable ability of this variety to yield well and consistently under our ordinary conditions.

At Brundah some three years ago, 3,000 odd acres were planted with Federation. From this area 13,040 bags of grain were sold, and sufficient seed for next year's sowing was retained by the station. The average yield

over the whole area was 22 bushels per acre. For that year, this was probably the biggest average in the State for a large area, and it was also probably the largest area of any one variety planted.

The production of this variety was the result of a deliberate attempt on the part of Mr. Farrer to produce a variety with short straw, specially suitable for the Australian methods of harvesting with the stripper. The remarkable popularity of this variety, as the result of its behaviour in the field, affords abundant evidence that he was singularly successful.

Federation is an early variety, of about the same season as Steinwedel. On account of its short straw, erect and scanty growth, it is not an attractive variety in the field, and does not appeal to the farmer who has been accustomed to the luxuriant growth and pleasing appearance of Purple Straw and similar varieties. If judged by appearances, Federation would never have become popular. Fortunately for it, and for the farmers of the State, it is the number of bags per acre which turns the scale when the merits of any particular wheat are in the balance. As Federation, despite its unattractive appearance, is able to produce the necessary bags, it has become, and remains, the most popular variety of the present time.

It produces the maximum amount of grain for the minimum amount of straw. Its upright head enables the operation of stripping to be done easily. It holds its grain tightly enough to prevent shattering, yet strips without difficulty. It is not easily damaged by storms, and because of this some farmers have called it "storm proof." Its erect head, which in some respects is its strength, is also an element of weakness in that it allows the rain to easily enter the ear. Because of this the grain becomes bleached as the result of a slight shower.

As a milling wheat, it is in the Soft White class; but though it belongs to this class its strength is satisfactory, and is a decided improvement upon varieties of the old Purple Straw type.

Federation is both rust and bunt liable. It also seems specially susceptible in the spring to the attacks of powdery mildew (*Erysiphe graminis*), which, however, does not seem to exercise an injurious effect upon the yield.

Because of its short, stiff straw, it is not a hay variety, and cannot be recommended for that purpose, especially if the hay is intended for market. Farmers use it for their own stock with very satisfactory results. The stock are said to eat it readily and with relish. The yield of hay from a crop of Federation is very much greater than its appearance would indicate. A yield of 2 tons is quite common, and between 3 and 4 tons are sometimes obtained.

Firbank.

Firbank is a tall erect-growing variety which stools rather scantily. The young plant carries a moderate amount of foliage of good colour. The leaves are broad, long, and limp. The ripe straw is fairly stout and white in colour. The ears are long, open, and tapering, and are slightly tip bearded. The chaff is white, smooth, and inclined to be close. The grain is large, white, and plumpish.

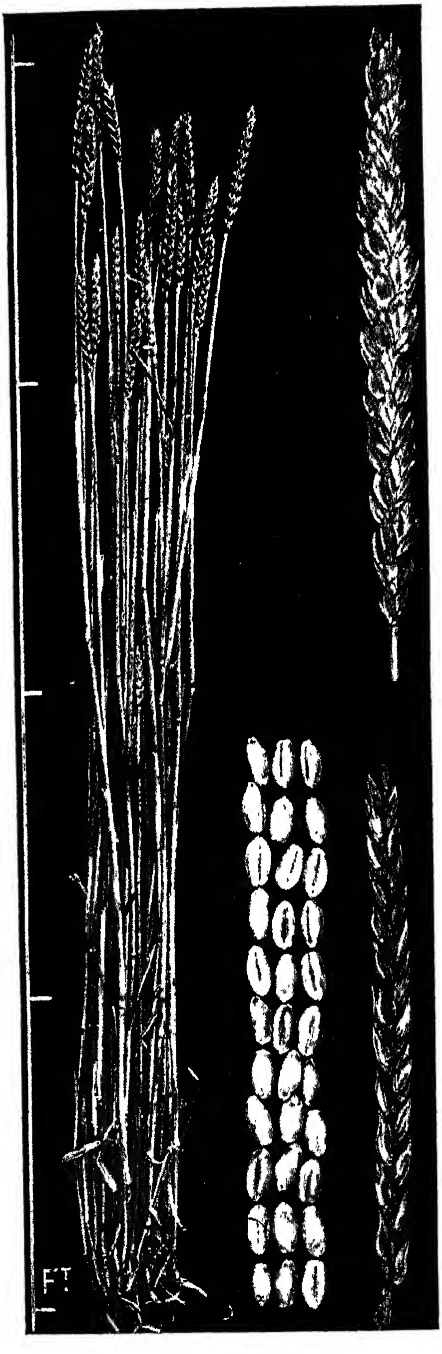


Fig. 5.—Federation.

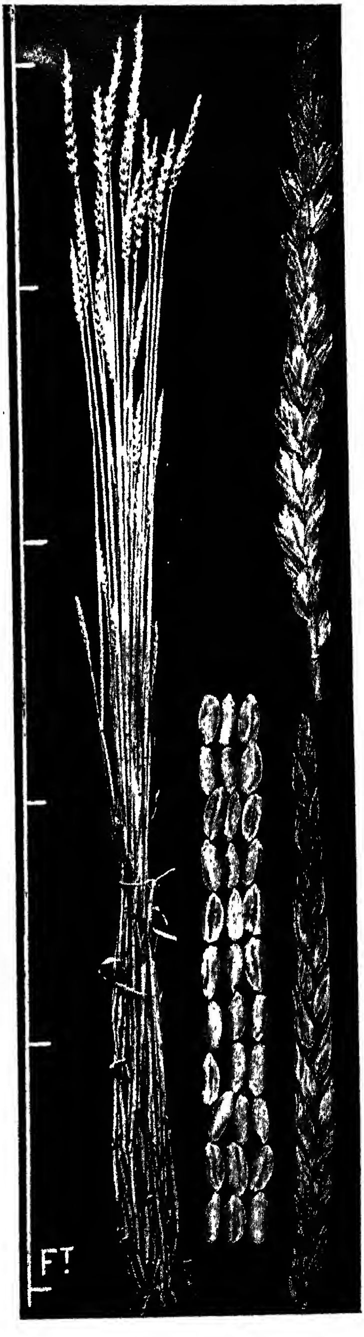


Fig. 6.—Firbank.

Varieties of wheat recommended by the Department of Agriculture.

Firbank is a half-sister to Bunyip, both varieties having the same sire. It was produced by mating Zealand with Maffra. Its pedigree is :—

Blount's Lambrigg × Hornblende

Unnamed × King's Jubilee

Zealand × Maffra

Firbank

This variety is very early, being about a fortnight earlier than Steinwedel, and about the same season as Bunyip. It is specially suitable for hay, the straw being sweet, soft, and of excellent quality. It is green right to the base, with little or no dry flag.

It should be sown about mid-season, as early-sown crops are subject to frosting and become ready for cutting before the weather is hot enough to cure the fodder properly. But if sown early the crop will be ready to cut for ensilage before the black oat ripens, and if utilised in this way it will prove a very valuable aid in profitably ridding dirty paddocks of that pest.

Though more particularly a hay wheat, it is by no means an indifferent yielder of grain. As a milling variety it belongs to the Soft White class.

It is more suited for hot than for cool districts.

(To be continued.)

New South Wales Strong White.

In our issue of December, 1909, Mr. Geo. L. Sutton, Wheat Experimentalist, suggested that an effort should be made to secure proper recognition of the milling qualities of our Departmental cross-bred wheats, such as Comeback, Jonathan, and Bobs, by classing them under the designation of "New South Wales Strong White." By such a method, the "Canadian No. 1 Hard Red" has come to be recognised as the standard of the world for quality, and our wheats compare very favourably with it. Our present method is to mix all varieties of grain together to get the F.A.Q. standard; but what Canada has done New South Wales can do.

We therefore suggest that some of our farmers should take this matter up by sending to Great Britain a fairly large sample of the best of our hard wheats, selling it in the open market, and getting an expert report upon it from a milling point of view. The wheat should be graded before shipment, so that the consignment would be a type sample of "New South Wales Strong White." The matter was brought before several of the biggest wheat-handlers in the Old Country some time ago, when they intimated that a consignment of at least 1,000 quarters would be required.

If this proposal be carried out the price realised should amply compensate the pioneers of the movement for their trouble; and the result would be to educate our wheat-growers into the advantage of keeping their varieties pure and cultivating only the best, which will bring the highest price on the English market.

Brown Rot of Fruit

T. HARVEY JOHNSTON, Bureau of Microbiology.

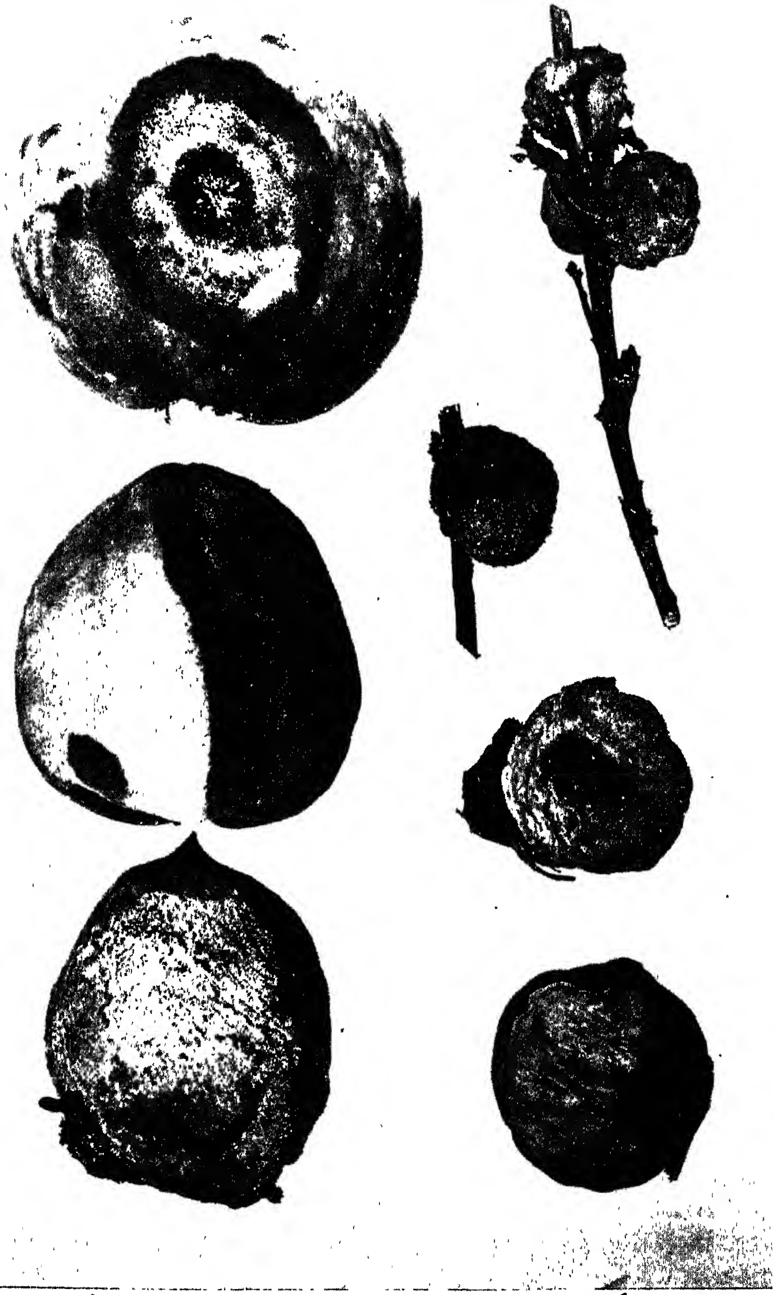
RECENTLY there have been submitted for examination specimens from various parts of New South Wales showing a considerable amount of destruction of fruit by certain fungi which produce "brown rotting." One of these is *Glœosporium fructigenum*, which attacks apples, tomatoes, peaches, and occasionally other fruits in our State. As it more commonly infests the apple it is often termed Apple-rot, Apple bitter-rot, or Ripe-rot. This fungus produces brown discolorations which cause the affected part to appear as if decayed. These diseased areas are bitter to the taste. They increase in size but still remain fairly firm, and on the surface a number of small whitish or (more usually) pinkish pustules appear. These contain myriads of spores capable of setting up infection on sound fruit, especially under the conditions of ordinary storage.

It has been stated that Bordeaux mixture or ammonio-carbonate of copper solution, applied to the trees while the fruit is young, is effective in checking the disease.

The commonest fruit-disease in our markets just now is the Brown Rot produced by quite a different fungus, *Monilia fructigena*. This parasite occurs on the following fruits in New South Wales, viz.:—peach, nectarine, ordinary plum, Japanese plum, apricot, cherry, apple, and pear, especially on the first four named.

The accompanying photographs show the typical appearance of peaches and nectarines suffering from this disease. The affected part becomes brown and softened and soon rots. On the surface there appear more or less concentric areas covered by a greyish substance which, under the microscope, is seen to be made up of the spores (*conidia*) and spore-bearing organs (*conidiophores*) of the fungus. In a very short time the whole fruit becomes affected, but instead of falling from the tree, as is usually the case with dead fruit, it may remain on the tree, becoming shrivelled up to form what is popularly known as "mummy fruit." This appears as if it had been dusted with ashes, owing to the abundant formation of spores. Several such mummified nectarines are shown in the photograph.

If the "flesh" of the diseased fruit be examined microscopically, there will be seen abundant fungal threads (*mycelial hyphæ*) penetrating the cells. It is this mycelium which, at points along the surface, pushes its way into the air, where it forms branched conidiophores capable of giving rise to the spores. These spores become dispersed by insects and especially by wind and rain. They are able to reproduce the fungus, and germinate very readily in water or in the juices of the fruit. Any kind of wound, even an insect puncture, may afford an opportunity for the germinating spore to



Brown Rot (*Monilia fructigena*).

Peaches and Nectarines showing progressive stages in the development of the disease.

infect the part. No doubt the recent warm moist weather over our coastal districts has produced favourable conditions leading to the present epidemic of this fungus. The brown rot readily extends in ordinary storage from diseased to sound fruit, owing to the surroundings being favourable for its development. The affected fruit may "nest" together; hence the importance of eliminating those which are unsound.

The twigs are also attacked, consequently the name "twig-blight" is often given to this disease. Such blighted parts of the tree bear little or no fruit, and gumming often occurs, allowing of the entry of other organisms. These may accelerate the death of the affected part, and the formation of a canker frequently results.

From what has been said above, it will be seen that the removal and destruction by burning, of all diseased fruit and twigs should be carried out. It has been recommended that trees should be sprayed with dilute Bordeaux mixture in early spring while the foliage is still young and the blossoms not yet open, and again just after the fruit has set.

Economical Irrigation.

A cheap and inexpensive way of doing things is always of value to the man on the land. Mr. Davis, of Falls Creek, near Nowra, has happily thought out an effective way of irrigating his vineyard by means of a windmill made out of a sulky wheel and axle-bar.

There are two of these mills at work on the place, and, by the way Mr. Davis speaks, they give satisfaction. They are roughly put together, and could be fixed without going to any great trouble or expense, and yet present a neat appearance. The fans are composed of galvanised iron, cut 4 feet long, narrowing down from 1 foot wide at the broad end, and are bolted on to the spokes.

The wheel is screwed tightly on to the axle-bar, which is bent in the middle where it is connected with the piston-rod. The tail is made of split hardwood battens, and the tower of rough bush saplings.—R. A. Makin.

Destruction of Prickly-pear.

An experiment was recently made under the direction of the Bureau of Microbiology, acting on a suggestion for the destruction of prickly-pear, by driving copper nails into various parts of two plants at Milson Island. The nails caused decay of the parts immediately in contact with them, but apparently did not give rise to any diffusible substance capable of injuring the plant as a whole. A protective layer of cellulose was formed at the site of injury.

Bees, and Spraying Fruit Trees.

Many orchardists are also bee-keepers, and the interests of the orchardist and the bee-keeper are interwoven in a remarkable way. It is generally admitted that bees are the most important agents in pollination; consequently they fairly pay for the nectar they take from the orchard.

Bee-keepers in this State have complained that injury is being done to their bees by spraying fruit trees with poisonous substances before all the blossoms have fallen; but the Department of Agriculture has no records, either from at home or abroad, that the spraying of fruit trees for codlin moth has had any direct influence on the honey bee, the general opinion being that bees will not collect either honey or pollen from trees thus sprayed.

In their own interests, the growers of this State have never practised spraying apple and pear trees whilst in bloom, but immediately after the petals have fallen. Spraying trees in full bloom would destroy the pollen and the delicate organisms of the stigma of the blossom, and in the Orchard Notes in this *Gazette* growers are always advised to spray immediately after the petals have fallen. Nevertheless, there must often be a few late blossoms in large orchards which remain after the trees are sprayed, and it would be valuable to have the doubt set at rest whether or not bees will collect honey or pollen from blossoms sprayed with such materials as arsenate of lead. In the meantime we would warn fruit-growers against the possible danger, and urge upon them to avoid spraying trees in bloom; to do so is to risk doing injury to little friends whose co-operation in the orchard cannot be readily dispensed with.

Berry Stud Farm.

Monthly Dairy Return.

Number of cows milked during month of January, 1910—39.

Amount of milk yielded—2,319 gallons.

Amount of milk used—23,197 lb. as calf food.

Weekly Fat Test per cent. of the Mixed Milk of Herd:—

1st week	... ..	3·9 per cent. fat.
2nd ,,	... ...	3·7 ,, ,,
3rd ,,	... ...	3·8 ,, ,,
4th ,,	... ...	3·7 ,, ,,

Remarks *re* weather conditions and food:—Wet, but mild. Grass scarce in early part of the month, afterwards growing rapidly.

Remarks *re* yields of different breeds:—Holsteins yielding up to 3 gallons; Jerseys, 2 gallons; Shorthorns, 3½ gallons; Ayrshires, 3½ gallons; Guernseys, 3 gallons; Kerry—old Belvedere Bratha 3rd, 4 gallons.*

1st February, 1910. P. QUIRK, Manager.

* Note the yield of the old Kerry cow—Belvedere Bratha 3rd, now aged 15 years.—M. A. O'Callaghan.

Studies in Dairy Cattle Breeding.

The Influence of the Sire.

M. A. O'CALLAGHAN.

While the geological history of the ox is not as complete and satisfactory as zoologists would desire, still it is known that at a period there were only two great races or breeds of cattle, viz., the *Bos primigenius*, or "Urus," and *Bos longifrons*, or "Celtic," and to either of these two great races, or to an admixture of both, can now be traced all modern British breeds. Though Great Britain is now, practically speaking, the cattle experiment station and stud farm of the world, where people from all countries go to select new breeds and new individuals, when they are in need of fresh blood, the countries of Middle Europe probably had the advantage of a superior race of cattle in early times. As the Jutes, the Angles, and the Saxons came to England, however, they brought their farm animals with them, and their cattle supplanted in the districts in which they settled the smaller beasts common to Great Britain in those days. Thus it is that the small ox, or Celtic type, gave place to the "Bos urus," or Teutonic type. The owners of the former were driven northwards and westwards, and there went their cattle with them, until to-day we find the homes of the Celtic type (which is probably most truly represented in the Kerry cows, of Ireland) confined mainly to the more isolated portions of the British Isles. Of course, these two races, or breeds of cattle, viz., the *Longifrons* and the *Urus*, like the peoples whom they represented, became intermixed, and several new varieties or breeds became established throughout Great Britain, such as the Ayrshire, the Devon, and the Angus. Selection, environment, soil, and climate will in time so affect a race of cattle that it will not be recognisable with the original stock from which it sprung. Hence it is that England, with its enterprising and intelligent live-stock breeders, and its variety of geological formations, has given to the world so many distinct breeds, or types, of cattle. Among the *Longifrons*, or Celtic type, are still classed such well-known breeds as the Jersey, the Guernsey, the Kerry, and the Galloway. These animals had, comparatively speaking, short horns, while the typical *Bos urus* had long horns, the Teeswater, the Holderness, the Irish Longhorn, and the Hereford being representatives thereof; and to-day we have descended from them (with the horns bred short by selection) that breed which has become so famous all over the world, viz., the Shorthorn.

Maintenance of Type.

The various British breeds, as now established, will maintain their type while bred in their own particular districts, but when transferred therefrom a difficulty is experienced in the case of many well-known breeds, and it is necessary, from time to time, to go into the original homes of these distinct breeds to select fresh blood, in order to keep up the continuity

of type. Breeders of stock in Australia will find this applicable not only to cattle but also to horses, and more especially to the Thoroughbred, and a country situated so far from the homes of these different breeds as is Australia, must necessarily suffer considerably for the want of the reconstitution of type by the introduction of fresh blood into its dairy herds.

Government Importations.

Hence, in the year 1898, the New South Wales Government, acting on my suggestion, imported a number of cattle from the British Isles and Europe, with the object of improving our dairy herds. About that time dairying began to expand very rapidly, and the supply of good cattle for dairying purposes was not at all equal to the demand. With the exception of a few well-known South Coast breeders, and their relatives on the North Coast, the breeding of dairy cattle was considered not worthy of great attention. The average dairy-farmer at that time made no attempt towards the improvement of his herd by breeding; in fact, the advocate of pure-bred sires, in most cases, met with a cold reception. I remember well the difficulty which I experienced in getting the general dairy-farmer to discuss the question from an intelligent standpoint. Any sire was considered good enough to beget a calf for dairy purposes, and with the exception of the few people mentioned above, the herds were headed by inferior cross-bred sires of no particular type. After all, it is not surprising to find a want of belief amongst farmers regarding the influence of the sire in improving the milking characteristics of the dairy herd, when it is borne in mind that at a recent dinner of the Shorthorn breeders of Great Britain and Ireland, the chairman, in his speech, remarked that "it was doubtful if the sire had any influence on such a feminine trait as the production of milk." Systematic experiments on this point have not been recorded, and the well-founded belief amongst breeders that the sire has a very great influence in this direction comes as the result of their general experience and observation. It is easy to challenge the result of any such general observations when there is no specific data to fall back upon, but the old saying: "The bull is half the herd" is, it appears, under-estimating, rather than over-estimating, from a dairy point of view, the influence of the sire, especially when the herd is an inferior one. The advantage of an animal bred on the same lines for generations, in other words, the pure-bred bull, was emphatically believed in by the Australian breeder of beef cattle long before the average dairy-farmer could be induced to admit this advantage. To show how backward farmers were on this subject about twelve years ago, I might state that when judging at a show in a now advanced dairy district, I was strongly condemned for declining to award a first prize to an admittedly half-bred animal of the Jersey breed, and an inferior one at that. Nowadays, the man who would exhibit a half-bred Jersey bull at a show in that district would be laughed at by the other exhibitors. In fact, so little was thought of the advantage of a pure-bred sire, that when the importation previously referred to was made in 1898, a difficulty was experienced in getting farmers to accept a

lease of the animals introduced. The Guernseys were practically neglected, as far as applicants for their services were concerned, whereas now the demand for the lease and purchase of young bulls of this breed is considerably greater than the supply. In addition, all our intelligent dairy-farmers, no matter what breed of cattle they use, now endeavour to procure a pure-bred bull of that breed. This I attribute, to a very great extent, to the education which has been afforded by the leasing of the pure-bred (imported) bulls by the Government to representative farmers in different parts of the State, and to the information afforded by the earliest results of the series of experiments mentioned below. These imported animals stamped their characteristics on almost every calf they got, and this advertised more quickly than anything else could have done the advantage and superiority of the pure-bred animal over the cross-bred for begetting his own characteristics in a high percentage of his progeny. In fact, this is the only feature, practically speaking, on which the pure-bred animal beats the cross-bred. Any half-bred sire, well descended for milk, will beget, if mated with fair dairy cows, a certain percentage of his progeny of good dairy characteristics; but it is claimed for the pure-bred animal, of a good milking family, that he will get a very much greater percentage of his progeny superior in dairy character than will the half-bred bull, equally well descended from the milking point of view. We know that when an animal departs from the fixed type, and throws back, the reversion is to inferiority, and, in fact, this happens in many cases, despite the influence of even a pure-bred sire and dam.

Yields of our Dairy Cattle.

Although we cannot expect that the yields of dairy cattle in New South Wales shall be equal to those in countries where droughts are practically unknown, we can at least expect good records from those districts where droughts are rare, such as the Richmond River district. But a review of our dairy statistics shows that the cattle of even our most-favoured districts have yet to make a very great improvement before they can be considered up to the standard of good average dairy cows. After taking some trouble to check the statistics as furnished to the Government Statistician, by comparing the estimated yield with the actual factory returns, I have come to the conclusion that the figures published by the Government Statistician are sufficiently reliable as regards our principal dairying districts for our purposes. The following are the averages for the year 1907:—

District.	Milk yield in gallons.
Counties of Rous and Richmond	363
Clarence district...	292
Hunter River Valley	263
Ulladulla and Moruya districts	319
Auckland (Bega district)	284
Macquarie district (which includes the Manning and Hastings districts)	290

Owing to the great development of dairying during recent years, the demand for young dairy cattle was greater than the supply, and, as a result of this, all female animals were bred from, and all heifers reared in dairying districts were brought to the dairy. Hence there was absolutely no selection, and therefore we have a great percentage of very inferior dairy animals. Of late, however, a change for the better has set in. The supply has more than reached the demand, and, as a consequence, prices for young dairy heifers are so low that farmers will, for some time at least, only rear heifer calves from their very best cows, and thus we should see a distinct improvement in our milk yields in the next few years.

Experiments.

Seeing the carelessness which existed regarding the use of pure-bred dairy sires, I was stimulated to inaugurate the series of experiments given below. Dairying in New South Wales is mostly done from the butter-maker's point of view, and to me there appeared a necessity for an animal of special butter-producing tendencies, and of a fairly large frame, so as to be suitable for the carrying on of the industry on our rich river flats, and on the upland prolific, volcanic lands of the Richmond River district. The Jersey had been tried to some extent, but did not receive the stamp of approval generally from dairy-farmers. The Jersey failed because of the great tendency of this breed to throw "brindles" when crossed with ordinary stock, and also because the half-breeds were too small to satisfy the requirements of the farmers carrying on dairying on our rich lands. The Ayrshire-Shorthorn cross had been thoroughly proved from a milking point of view; but this animal is not properly bred for special butter-producing purposes, owing to the low percentage of fat in the milk. It occurred to me that the Guernsey, on account of its larger frame and hardier constitution than the Jersey, would meet our requirements to a great extent, especially as the Guernsey does not beget "brindles" when crossed with cattle of the predominating colours. Thus it was that in the series of experiments begun, the crossing with the Guernsey sire was given premier place. The following is a summary of the points aimed at in these experiments:—

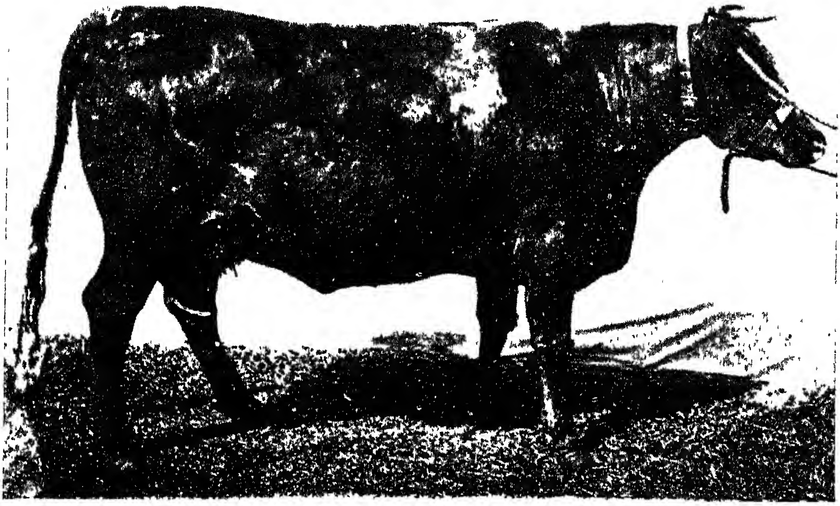
(*a*) To ascertain the influence, if any, of the sire in relation to the milk yield of his progeny;

(*b*) To determine if it is possible, through the influence of the sire, to obtain heifers from beef-bred animals, which will show marked dairy tendencies; or, in other words, to see if it is possible to cross out beef and cross in milk in a generation or two through the influence of the bull;

(*c*) To find out what breed of cattle, if any, was most effective in bringing about results (*a*) and (*b*).

(*d*) To ascertain the value of the Guernsey cross on the local cattle of the Richmond River of the Shorthorn type;

(*e*) To endeavour to fix a type of dairy animal of Guernsey type and characteristics, but of a larger frame, and a more robust constitution.



Photograph No. 1.—Shorthorn Cow, Bella.

Photograph No. 2.—Pebble. Sire, Peter; dam, Bella. As a heifer on first calf.

There is no better means of ascertaining knowledge regarding section (*a*) of the experiments than to select cows of poor milking tendencies, or animals that have been bred on beef lines for generations, and mate them with pure-bred bulls of recognised dairying breeds. Hence some Shorthorn cows, bred on a beef-cattle station on the Liverpool Plains, were sent to Wollongbar, and mated with Guernsey, Ayrshire, Milking Shorthorn, and Holstein bulls.

Regarding sections (*a*) and (*b*) of the experiments, we have results by bulls of the Guernsey, Ayrshire, and Milking Shorthorn breeds, but, up to the present, we have not had any results by the Holstein, owing to the fact that the progeny of this bull, when mated with the beef Shorthorns referred to, were males.

Regarding section (*d*), results of first and second crosses on this line of breeding have now been obtained both by ourselves and by numerous farmers to whom we have leased Guernsey bulls; but sufficient time has not yet elapsed for us to be able to say definitely whether the first cross is better than later crosses.

Readers will see that for the principal portion of the experiment, pure-bred cows have been selected in every instance for the *bases*. It was thought more advisable to do this than to begin on cross-bred animals, where the tendency to throw back to something unknown would be greater.

Results of Experiments.

No. 1 BASE COW, BELLA (Pure-bred Shorthorn).—(*Photograph No.* 1).

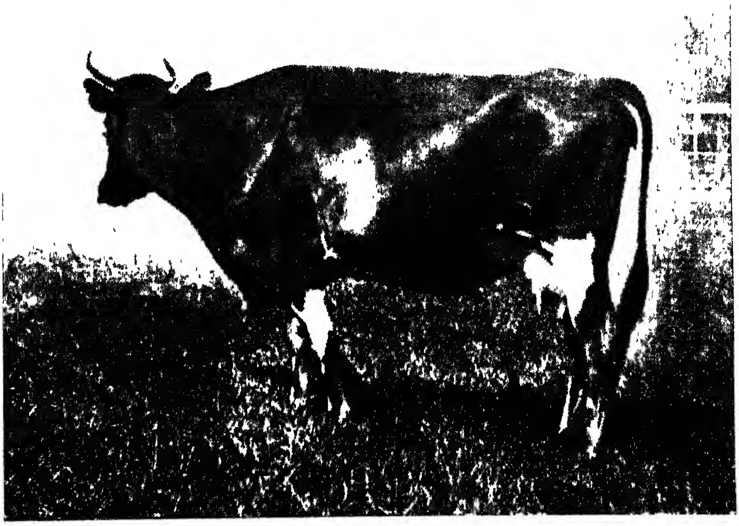
The antecedents of this cow had for years been used for beef purposes on Mr. Dangar's station, Mooki Springs. Bella was a handsome, dark-red cow, thoroughly characteristic of the modern Shorthorn, and if allowed to became fat, would undoubtedly have made a fine carcase. The rectangular form (as against the wedge-shape so common to dairy cattle), together with the deep, wide brisket, the thick shoulder, and, above all, the thick thigh, give evidence of the beefy tendency of this animal. She was purchased as a heifer when in calf, and was subsequently handled and treated as an ordinary cow. Her milk yield is given hereunder:—

Bella's Milk Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	No. of days in Milk.
		lb.	
Beef Shorthorn	On 2nd calf ...	3,600	216
	,, 3rd ,, ...	4,120	206
	,, 4th ,, ...	3,950	212

Photographs Nos. 2 *and* 3.—PEBBLE (Guernsey Shorthorn).

Here we see Pebble, the daughter of Bella by the Guernsey bull, Peter (imp.). In No. 2 she is seen as a heifer on her first calf, and in No. 3



Photograph No. 3.—Pebble. Sire, Peter; dam, Bella. As a mature cow.

Photograph No. 4.—Peter (Imp.), Guernsey bull. As a three-year old.

as a mature cow, aged seven years. Pebble is of a yellowish-red colour, with a little white on the under line. She is much finer in the bone, and generally speaking, throughout, than her dam. The neck is longer and leaner; the hind quarter is flat and incurving; the shoulder is sloping, and high at the wither; and the flank is arched high. She has nice, fine waxy horns, very large milk veins, a good bag, with nice yellow teats, and a first-class flandrine escutcheon. The following are her milk and butter yields:—

Pebble's Milk and Butter Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Guernsey-Beef Shorthorn, 1st cross, by Peter, from Bella.	On 1st calf ...	8,490	...	588
	,, 2nd ,, ...	6,720	345	329
	,, 3rd ,, ..	8,720	401	389

All Pebble's progeny, so far, have been bulls, and hence the results of a second cross of the Guernsey on this family are not available.

Photograph No. 4.—PETER.

This photograph shows the imported Guernsey bull, Peter, the sire of Pebble.

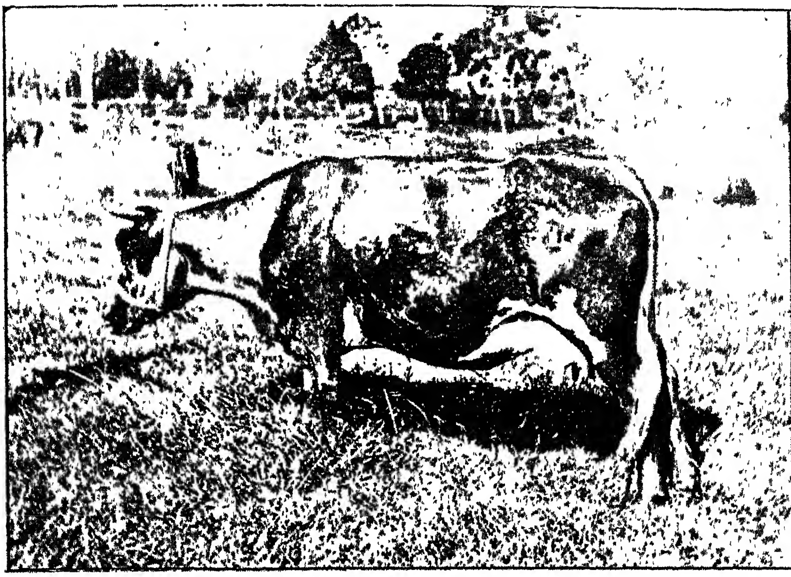
Photograph No. 5.—MOOKI LADY (Ayrshire Shorthorn).

Here is seen Mooki Lady, by the Ayrshire bull, Daniel of Auchenbrain (imp.), from Bella. Mooki Lady is a thick-set cow with a deep body on short legs. She is of an excellent dairy type, and though not quite so handsome in her lines as Pebble, still she gives evidence of a great constitution, coupled with good dairy points. Her body is of a deep wedge-shape; the head and neck are lean; the udder is well developed; the thigh is flat and incurving; the flank is arched high; and the tail is long and thin. This cow is of a pale red colour, with a little white. She might easily be mistaken for a half-bred Guernsey, and believers in the saturation theory will find support here, as the half-bred Guernsey referred to above, viz., Pebble, was the previous calf from the cow Bella. The following are Mooki Lady's yields:—

Mooki Lady's Milk and Butter Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Ayrshire-Beef Shorthorn, 1st cross, by Daniel of Auchenbrain, from Bella.	On 1st calf ...	5,396	245	333
	,, 2nd ,, .	5,042	236	251
	,, 3rd ,, ...	7,595	...	488
	,, 4th ,, ...	6,417	...	300

NOTE.—The average lactation period of a good cow should not exceed about 300 days. Any that are of a much longer period, such as Pebble while on her first calf, and Mooki Lady on her third calf, have occurred through the difficulty of getting the animals in calf, and the milk yields for these long periods should be judged accordingly.



Photograph No. 5.—Mooki Lady (Ayrshire Shorthorn). Sire, Daniel of Auchenbrain; dam, Bella.

Photograph No. 6.—Ayrshire bull, Daniel of Auchenbrain (imp.).

Photograph No. 6.—DANIEL OF AUCHENBRAIN (imp.).

This is the sire of Mooki Lady, viz., Daniel of Auchenbrain, an imported Ayrshire bull.

Photograph No. 7.—MOOKI BELLE.

In No. 7 is seen Bella's fourth calf, viz., Mooki Belle, by the pure-bred Dairy Shorthorn bull, Dora's Boy. She is of a yellow-red and white colour. The Shorthorn type is evident, but the animal is built on dairy, rather than on beef lines. Compared with her mother, there is very much more udder development, and that great characteristic of the milker, namely, the flat thigh and arched flank, is fairly well represented here. Mooki Belle is of a fair wedge shape, but a little deep in the brisket. She is a much better type of a dairy cow than one would expect to get from the mating of a Beef Shorthorn cow with even a well-bred Dairy Shorthorn bull. Her records to date are, however, somewhat inferior. The following are her yields:—

Mooki Belle's Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Dairy on Beef Shorthorn, 1st cross, by Dora's Boy from Bella.	On 1st calf ...	4,426	179	284
	,, 2nd ,, ..	4,250	163	215

Photograph No. 8.—DORA'S BOY.

Here is seen the sire of Mooki Belle, namely, the pure-bred Shorthorn bull, Dora's Boy.

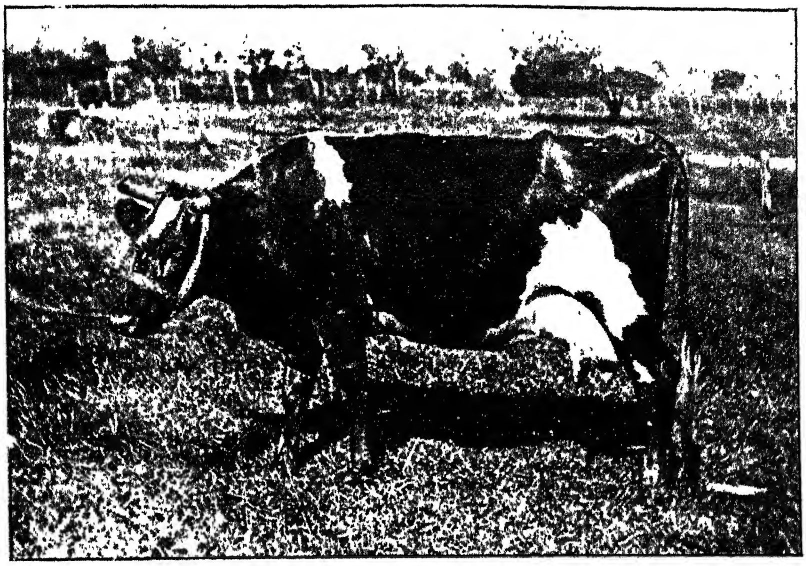
Second Crosses on the Bella family.

The second cross of the Ayrshire on this family is represented by two heifers, viz., Mooki Princess, by the very successful Ayrshire bull, Prince Royal, from Mooki Lady; and Lady Mischief, by Judy's Mischief (also a successful Ayrshire sire), from Mooki Lady. While Lady Mischief is too young to be in milk, the yield of Mooki Princess is available for the first two lactation periods, and is given hereunder:—

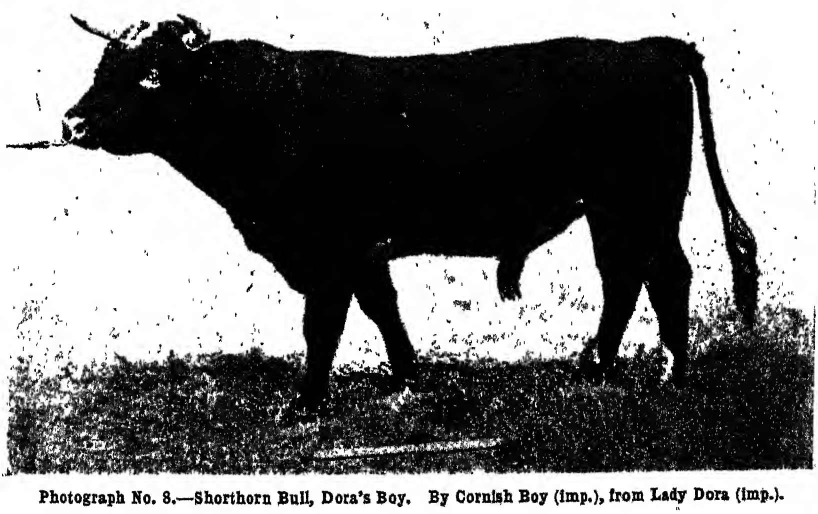
Mooki Princess's Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Ayrshire-Beef Shorthorn, 2nd Cross, by Prince Royal, from Mooki Lady.	On 1st calf ...	3,340	205	343
	,, 2nd ,, ...	3,760	187	220
	,, 3rd ,, ... (to date).	1,715	74	52

Mooki Princess's photograph will be given at a later stage.



Photograph No. 7.—Mooki Belle. Sire, Dora's Boy; dam, Bella.



Photograph No. 8.—Shorthorn Bull, Dora's Boy. By Cornish Boy (imp.), from Lady Dora (imp.).

No. 2 BASE COW, LADY DORA (imp.)—(*Photograph No.* 9.)

Here we have an animal, though of the same breed, the opposite in many respects to Bella (base cow, No. 1), as she is a heavy milking, pure-bred Dairy Shorthorn cow, and was imported from England in 1898. Her milk and butter yields are given hereunder:—

Lady Dora's Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Dairy Shorthorn	On 4th calf ...	8,120	...	...
	„ 5th „ .	9,560	416	265
	„ 6th „ ..	8,406	346	275
	„ 7th „ ...	7,875	296	367
	„ 8th „ ..	6,476	251	332
	„ 9th „ ...	5,902	225	296
	„ 10th „ ...	3,826	137	208

Lady Dora's Progeny.

Lady Dora (imp.) was mated with Shorthorn bulls on three occasions after her arrival in Australia, before being mated with the Guernsey bull, Peter. First, with Lord Sandgrave (imp.), a Shorthorn bull specially selected for dairying purposes; second, with Island King, a bull very well descended for milk on the mother's side, at least; and third, with Cornish Boy (imp.). The heifer from her by Lord Sandgrave had a very poor appearance as a dairy cow, but as she died young, we cannot state definitely what her milk-yielding capacity would have been. The progeny of Lady Dora by Island King was also a heifer named Lady Dora II. Lady Dora II's photograph is not available, but her records (given hereunder) were so bad that she was not kept longer than her third calf. She had all the appearance of a beef-bred Shorthorn.

Lady Dora II's Milk and Butter Yields.

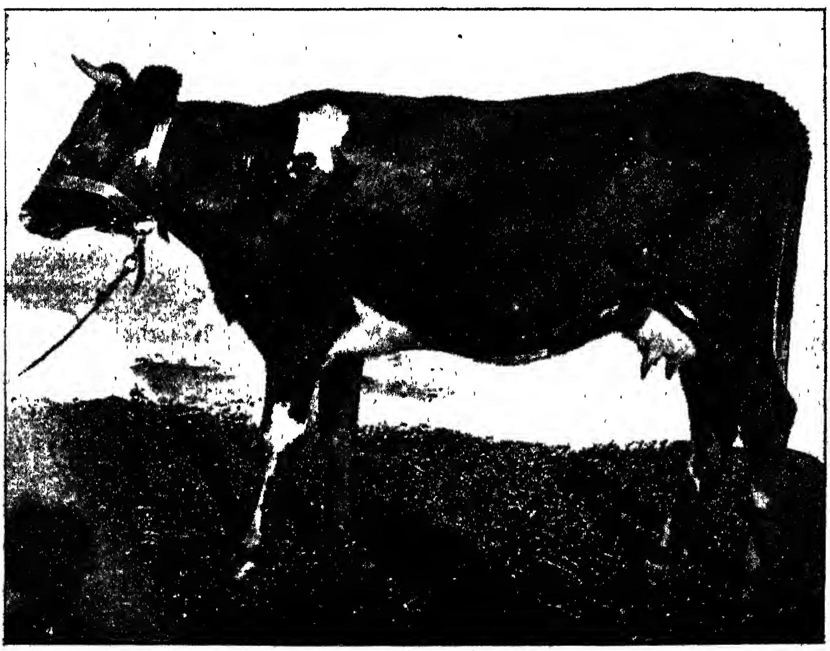
Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Dairy Shorthorn, 1st cross, by Island King, from Lady Dora.	On 1st calf ...	1,893	82	190
	„ 2nd „ ...	1,994	84	207
	„ 3rd „ ..	2,803	118	211

On Lady Dora's next calving, she had twins, viz., the Shorthorn bull, Dora's Boy, and a heifer which did not breed. Then she was mated with the Guernsey bull, Peter, and we got Doreen.

Photographs Nos. 10, 11, and 12.—DOREEN.

No. 10 represents Doreen as a heifer on her first calf, and No. 11 shows her as a mature cow, while No. 12 gives a good view of the con-

Photograph No. 9.—Shorthorn cow, Lady Dora (imp.).



Photograph No. 10.—Doreen. Sire, Peter; dam, Lady Dora. As a heifer on first calf.

Photograph No. 12.—Doreen.

formation of the udder and thighs. This cow has six teats, the extra, or rudimentary teats, being large and well-developed, and the cow has to be milked in these teats when she is in full flow.

This cow is of a yellow-red and white colour, with good length and fair dairy conformation, the thigh especially being very flat and the flank well arched. It would have taken a good judge, however, to have known at the heifer stage that she would develop into the handsome cow which is seen in No. 11. We see here a dairy cow of excellent wedge-shape, with graceful lines. The thigh has got finer in proportion to the rest of the body, and the flank is thin and arched high, allowing plenty of room for udder development. Hereunder are given Doreen's yields:—

Doreen's Milk and Butter Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Guernsey-Shorthorn, 1st cross, by Peter, from Lady Dora.	On 1st calf ...	6,103	280	299
	,, 2nd ,, ..	13,627	651	597
	,, 4th ,, ...	7,105	295	258
	,, 5th ,, ...	7,776	279	280

Doreen slipped a calf while on her second lactation period, and consequently the record for the second calf, practically speaking, combines two periods.

Photograph No. 13.—DORINDA.

No. 13 represents an in-bred cow named Dorinda, by Dora's Boy (see photograph No. 8) from Lady Dora. This cow is of a yellowish-red colour, and might easily be mistaken for a half-bred Guernsey. Once more the saturation theory is borne out to a very great extent. Her yields are given hereunder:—

Dorinda's Milk and Butter Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Dairy Shorthorn, 1st cross, by Dora's Boy, from Lady Dora.	On 1st calf ...	5,473	243	399
	,, 2nd ,, ...	4,403	190	275
	,, 3rd ,, ...	5,929	225	260

Second Cross of Guernsey on this Family.

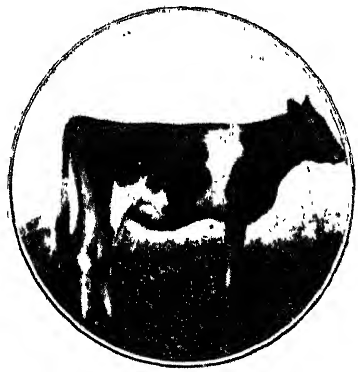
Viveen's Milk and Butter Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Guernsey-Dairy Shorthorn, 2nd cross, by Vivid's Prince, from Doreen.	On 1st calf ...	3,740	212	277
	,, 2nd ,,	3,586	192	263

Viveen is not, in appearance or otherwise, by any means a first-class dairy cow, and better results may be obtained from further daughters of Doreen by a Guernsey bull.

(Photograph No. 14).—
FULL BROTHER TO VIVEEN, NAMED EXPERIMENT.

Here is shown a young bull by the pure-bred Guernsey bull, Vivid's Prince, from the half-bred Guernsey cow, Doreen. As far as can be judged from the illustration, it would be difficult to say that he was not a pure Guernsey.



Photograph No. 14.—Experiment. Grade Guernsey bull.

No. 3 BASE COW, HONEY 110TH (imp.).

No photograph of Honey 110th is available. She was a Coate's Herd Book Shorthorn cow, imported from England in 1898, with Lady Dora and other Dairy Shorthorns. She was a rich roan in colour, lacking a good deal in wedge shape, and deep and wide in the brisket. The ordinary judge of dairy cows would class her as being much too beefy in type. Her yields are given hereunder:—

Honey 110th's Milk and Butter Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Dairy Shorthorn	On 3rd calf ...	5,950	...	210
	,, 4th ,, ...	No authentic record.		
	,, 5th ,, ...	5,327	225	220
	,, 6th ,, ...	4,960	210	292
	,, 7th ,, ...	5,382	234	241
	,, 8th ,, ...	4,324	193	281

During the same season, under the same food conditions, and on the same farm, Lady Dora gave 8,120 lb. milk, while Honey 110th gave but 5,950 lb.

Progeny of Honey 110th.

Shorthorn Cow—Honeydew.

Hereunder are given the milk and butter yields of Honeydew, daughter of Honey 110th, by Cornish Boy (imp.).

Honeydew's Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Dairy Shorthorn, 1st cross, by Cornish Boy, from Honey 110th.	On 1st calf ...	3,348	153	258
	,, 2nd ,, ...	4,101	170	317

Photograph No. 15.—HONEYSUCKLE (Guernsey Shorthorn).

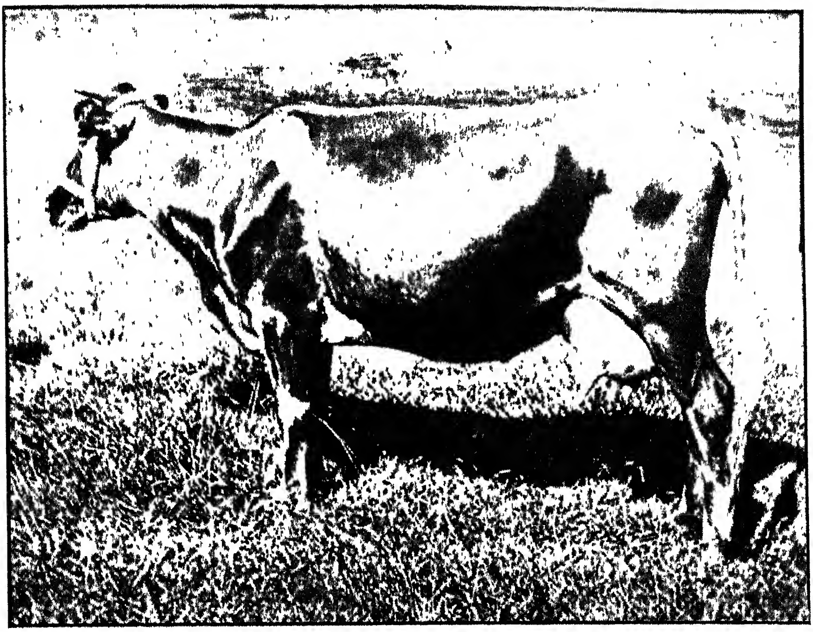
Here is seen a daughter of Honey 110th, by the Guernsey bull already referred to—Peter (imp.) Honeysuckle takes after her mother in colour to a very great extent, the colour of the Guernsey occurring only in the neck and face. That Honey 110th (imp.) was a heavy, coarse type of cow might easily be imagined when it is seen that her daughter, by a Guernsey bull, is of the heavy type shown in this photograph. Honeysuckle is lighter in the bone, more wedge-shaped, better on the thigh, and finer in the brisket than was her mother. Her milk and butter yields are given hereunder:—

Honeysuckle's Milk and Butter Yields.

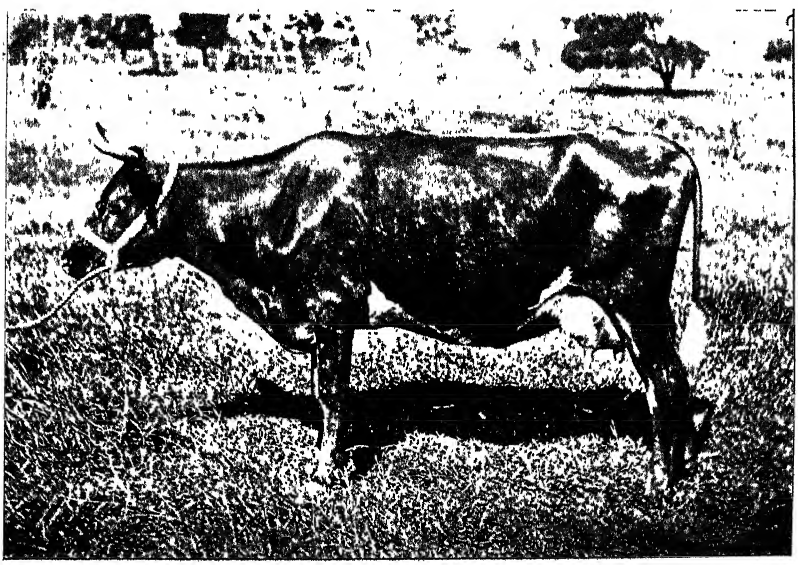
Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Guernsey-Shorthorn, 1st cross, by Peter, from Honey 110th	On 1st calf ...	4,765	309	311
	,, 2nd ,, ...	5,207	341	320
	,, 3rd ,, ...	6,671	445	363
	,, 4th ,, ..	5,502	329	328
	,, 5th ,, ...	7,205	383	372

Photograph No. 16.—HONEYDROP. (Second Cross.)

The second generation of Guernsey blood from the imported cow, Honey 110th. This cow, Honeydrop, is a daughter of Honeysuckle, by the pure-bred Guernsey bull, Vivid's Prince, and therefore the grand-daughter of the pure-bred Shorthorn cow, Honey 110th. In Honeydrop is seen a gradual reduction of the heavy Shorthorn type by the introduction of Guernsey blood for two generations on the sire's side. This young cow represents in every line the dairy shape. No inclination to flesh is evident anywhere, and when she matures she should have all the appearance of a first-class dairy cow. Comparing this cow with her mother, it is noted that the thigh is flatter and much more incurving, the tail is thinner, and the tendency to wedge-shape is greater. The roan colour is still preserved on the body, but the head and neck have further taken on the yellowish tinge of the Guernsey.



Photograph No. 11.—Doreen. Sire, Peter; dam, Lady Dora. As a mature cow.



Photograph No. 13.—Dorinda. Sire, Dora's Boy; dam, Lady Dora.

Photograph No. 15.—Honeysuckle (Guernsey Shorthorn). Sire, Peter; dam, Honey 110th.

Photograph No. 16.—Honeydrop. Sire, Vivid's Prince; dam, Honeysuckle.

Honeydrop's Milk and Butter Yields.

Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of days in Milk.
		lb.	lb.	
Guernsey-Shorthorn, 2nd cross	On 1st calf ... (to date).	3,411	168	154 still milking.

Comparative Yields.

For the purpose of making a better and more easy comparison of the yields of the various animals mentioned, the following tabulated statement is given:—

Name of Cow.	Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of Days in Milk.
Base Cow No. 1 and progeny—			lb.	lb.	
Bella	Beef Shorthorn	On 2nd calf	3,600	......	216
		,, 3rd ,,	4,120	......	206
		,, 4th ,,	3,950	.....	212
Pebble	Guernsey-Beef Shorthorn, 1st cross, by Peter, from Bella.	On 1st calf	8,490	.. ...	588
		,, 2nd ,,	6,720	345	329
		,, 3rd ,,	8,720	401	389
Mooki Lady ..	Ayrshire-Beef Shorthorn, 1st cross, by Daniel of Auchenbrain, from Bella.	On 1st calf	5,396	245	333
		,, 2nd ,,	5,042	236	251
		,, 3rd ,,	7,595	......	488
		,, 4th ,,	6,417	......	300
Mooki Belle ...	Dairy on— Beef Shorthorn, 1st cross, by Dora's Boy, from Bella.	On 1st calf	4,426	179	284
		,, 2nd ,,	4,250	163	215
Mooki Princess ...	Ayrshire-Beef Shorthorn, 2nd cross, by Prince Royal, from Mooki Lady.	On 1st calf	3,340	205	343
		,, 2nd ,,	3,760	187	220
		,, 3rd ,, (to date).	1,715	74	52
Base Cow No. 2 and progeny—					
Lady Dora ...	Dairy Shorthorn... ...	On 4th calf	8,120	... ..	......
		,, 5th ,,	9,560	416	265
		,, 6th ,,	8,406	346	275
		,, 7th ,,	7,875	296	367
		,, 8th ,,	6,476	251	332
		,, 9th ,,	5,902	225	296
		,, 10th ,,	3,826	137	208
Lady Dora II ...	Dairy Shorthorn, 1st cross, by Island King, from Lady Dora.	On 1st calf	1,893	82	190
		,, 2nd ,,	1,994	84	207
		,, 3rd ,,	2,803	118	211
Doreen	Guernsey-Shorthorn, 1st cross, by Peter, from Lady Dora.	On 1st calf	6,103	280	299
		,, 2nd ,,	13,627	651	597
		,, 4th ,,	7,105	295	258
		,, 5th ,,	7,776	279	280
Dorinda	Dairy Shorthorn, 1st cross, by Dora's Boy, from Lady Dora.	On 1st calf	5,473	243	399
		,, 2nd ,,	4,403	190	275
		,, 3rd ,,	5,929	225	260
Viveen	Guernsey-Dairy Shorthorn, 2nd cross, by Vivid's Prince, from Doreen.	On 1st calf	3,740	212	277
		,, 2nd ,,	3,586	192	263

Comparative Yields—*continued.*

Name of Cow.	Particulars of Breed.	No. of Lactation.	Milk Yield.	Butter Yield.	No. of Days in Milk.
Base Cow No. 3 and progeny—			lb.	lb.	
Honey 110th ...	Dairy Shorthorn... ...	On 3rd calf	5,950	......	210
		,, 4th ,,	No authentic record.		
		,, 5th ,,	5,327	225	220
		,, 6th ,,	4,960	210	292
		,, 7th ,,	5,382	234	241
		,, 8th ,,	4,324	193	281
Honeydew... ...	Dairy Shorthorn, 1st cross, by Cornish Boy, from Honey 110th.	On 1st calf	3,348	153	258
		,, 2nd ,,	4,101	170	317
Honeysuckle ...	Guernsey-Shorthorn, 1st cross, by Peter, from Honey 110th.	On 1st calf	4,765	309	311
		,, 2nd ,,	5,207	341	320
		,, 3rd ,,	6,671	445	363
		,, 4th ,,	5,502	329	328
		,, 5th ,,	7,205	383	372
Honeydrop ..	Guernsey-Shorthorn, 2nd cross, by Vivid's Prince, from Honeysuckle.	On 1st calf (to date).	3,411	168	154 (still milking)

Conclusions.

As a result of further experiments will be published in a later issue, and as it is at all times dangerous to draw conclusions when only a small amount of data is available, I would ask readers to defer their conclusions, especially with regard to the value of second crosses, until after further results have been published.

Deductions from Data given herewith. The bull's influence.

Sufficient data is given herewith, however, to enable deductions to be made on some points which we set out to investigate. The queries raised in (*a*) and (*b*) regarding the influence of the sire on the milking tendencies of his progeny, and the ability of a well-descended dairy sire to cross-out beef and cross-in milk, have, I think, been sufficiently answered to enable us to say with confidence that the bull exerts a very great influence on the milking capacity of his progeny. We have shown here that the mating of the beef-bred Shorthorn cow Bella has resulted, in the case of the Guernsey bull, in the production of a female of great milk and butter yielding capacity. Not only this, but instead of having a cow that went dry after a very short lactation period, we have produced an animal that shows a tendency to milk for a very long time after calving. This cow (Pebble) gave, on her third calf, more than double the quantity of milk which her mother gave on the same calf. This in itself should be sufficient to prove that the sire's influence in the production of that essentially feminine trait—milk-yielding—is a very material one. However, we have, from the same base, very much further support. The calf born to Bella from the Ayrshire bull, Daniel of Auchenbrain, while not equalling the high results of the Guernsey cross, gave

on her first calf 5,396 lb. milk, as against the highest yield of her dam at any time, viz., 4,120 lb. The milk obtained from the Ayrshire cross, it is seen, was not as rich as that obtained from the Guernsey cross, nor was it expected to be. But here again we have distinctive proof of the influence of the sire, going to show that not only does the sire influence the quantity of milk from his progeny, but the quality also.

Query (*c*).—Comparative Influence of Different Breeds of Bulls to cross-out Beef and cross-in Dairy Characteristics.

So far as the records go, the Guernsey has produced the best results in this direction, but good results were also obtained by the Ayrshire cross. It was rather unfortunate that only bull calves resulted from the mating of the cow Bella with Holstein bulls. The results in regard to the Shorthorn are not nearly so satisfactory as are the results obtained by the Guernsey or Ayrshire crosses. The ability of any Shorthorn bull to eliminate beef traits from, and give milking characteristics to, other breeds is undoubtedy not great, as is disclosed in these experiments.

The results of the crosses with Base Cow No. 2, viz., Lady Dora, go strongly to support the results obtained from Base Cow No. 1 regarding the influence of the sire. Here we see a cow of great milking capacity mated in the first instance with a Shorthorn bull that was well descended for milk on the mother's side, and the result, viz., Lady Dora II, is a conspicuous failure, the animal having favoured the production of beef to such an extent that her milk yield was a wretched one during the first three lactation periods. On the other hand, when mated with the Guernsey bull, Peter, Lady Dora produced an animal of excellent dairy shape and of great milk-yielding tendencies, viz., Doreen. But for meeting with a mishap when on her third calf, I think Doreen would have exceeded any record put up by her mother. Prior to giving birth to Lady Dora II, Lady Dora was mated with the Shorthorn bull, Lord Sandgrave (imp.), and here also failure resulted, for beef rather than milk was produced. The performances of this latter animal are not available, because she died young; but her best record was 24 lb. milk in a day.

A contrast of the influence of the sire is again shown in the case of the progeny of the Shorthorn cow, Honey 110th (imp.). Here it is seen that the records of the cow Honeydew was only 4,101 lb. milk, producing 170 lb. butter, in a milking period of 317 days, on her second calf; while her half-sister, Honeysuckle, by the Guernsey bull, Peter (imp.), gave 5,207 lb. milk, producing 341 lb. butter, in a milking period of 320 days, on her second calf. It is thus seen that the butter-producing capabilities of the Guernsey-Shorthorn cross in this case was double that of the pure-bred Shorthorn; and on successive calvings it is seen that this young cow, Honeysuckle, excelled considerably the records of her dam, who though imported as a Dairy Shorthorn, was not by any means a typical dairy cow, being much too heavy in the fore part, and too much inclined to lay on flesh.

An In-bred Dairy Shorthorn.

We now come to the in-bred cow, Dorinda, Lady Dora having been mated with her own son, Dora's Boy, the year immediately following the birth of the half-bred Guernsey cow, Doreen, thus obtaining a concentration of Dora blood. Dorinda, as far as appearances go, is a good type of dairy cow, but an animal that might easily be mistaken for a Guernsey-Shorthorn cross. As the records of her milk yields show, she is a good dairy cow compared with the standard of pedigree Shorthorns, having given 5,929 lb. milk on her third calf. The sire, Dora's Boy, is of a much more highly-developed milking type than was either of the Shorthorn bulls that had been mated with Lady Dora previously, viz., Lord Sandgrave (imp.), and Island King.

Second Crosses.

The data given is rather in support of the general belief that the first cross is the best; but the second crosses are not yet developed cows, and before definite conclusions are drawn, readers would do well to wait for further results. The young cow, Honeydrop, the second Guernsey cross on the Shorthorn from Honey 110th, has all the appearance of growing into a first-class dairy cow.

The Influence of the Sire v. that of the Dam.

The average farmer is of opinion that a high-class dairy cow will produce a good milker, no matter with what class of bull she is mated. As far as these experiments go, however, the evidence is all the other way about; and though the secretion of milk is essentially a feminine trait, still the sire's influence thereon is apparently greater than that of the dam. Take the case of the cow, Lady Dora (imp.). It is seen that when mated with Shorthorn bulls (one of which was well descended for milk on the *dam's side*), the results were beef rather than milk, despite the fact that the cow herself was not only a typical dairy cow, but an extremely heavy milk-producer. On the other hand, when mated with a Guernsey bull of undoubted dairying strain on both sides, we find that she produced a female that, if not quite as heavy a milker as herself, was of a very high standard. The only satisfactory result obtained by mating Lady Dora with a Shorthorn bull was when she was put to her own son, Dora's Boy; and here, though the progeny is a good dairy cow, she would not be put down on appearance as a pure-bred Shorthorn. Then, looking at the progeny of Base Cow No. 3, viz., Honey 110th, it is seen that we again got poor results when she was mated with the Shorthorn bull, Cornish Boy, whereas, when mated with the Guernsey bull, Peter, we got an animal of an exceptionally high-class dairying character, viz., Honeysuckle. Again, look at the results obtained from the beef Shorthorn cow, Bella. Here the sire's influence altogether counteracts the influence of the dam as far as milking tendencies are concerned. Bella was a beef animal in make, shape, and results; and we have all her tendencies in

this direction overcome by the influence of the sire. It would thus appear that, from a dairying point of view, *the bull is considerably more than half the herd.*

The man who would be successful in cattle-breeding experiments must be equipped, above all things, with a good stock of patience. Conclusions must not be arrived at from insufficient data. Time is required; and though ten years may seem a long time, still it is very little when a work of this kind is contemplated; in fact, any successful stud-master will tell you that a lifetime is almost too short for the development of experiments along certain lines of breeding, especially when new ground is being broken. It was not until long after the death of the Brothers Colling that the results of their lives' work benefited to the full both the Shorthorn breeders who followed them, and the Shorthorn breed. Accidents occur, and often the wrong sex is born. This delays the student of animal breeding considerably more than persons unacquainted with this class of work can possibly estimate. In the studies recorded here we have been very lucky in some respects. For instance, we were very fortunate to get three heifers in succession from Bella by bulls of three different breeds. On the other hand, though we obtained heifers from the Guernsey, Ayrshire, and Dairy Shorthorn sires, we were not successful in obtaining a heifer from Bella (nor from two other cows tried) by Holstein bulls. Then Pebble, who is a somewhat shy breeder, has given us no female progeny so far; so that we have been unable to get any records of a second-cross Guernsey on this particular family.

References to Bulls used in the Experiments recorded.

Peter (imp.), by Nobleman, from Polly des Paisans. Bred by H. J. Gibbs, Milford, Salisbury, Wilts.

This bull proved a success, practically, wherever tried, with regard to the begetting of females of heavy milking tendencies. There are a great many heavy milkers by him at present on the State farm at Wollongbar, and on several private dairy farms on the Richmond River. (See photograph No. 4.)

Daniel of Auchenbrain (imp.), by Sir Thomas of Auchenbrain, from Craig of Auchenbrain. Bred by Robert Wallace, Auchenbrain, Mauchline.

Daniel of Auchenbrain was not a typical Ayrshire bull of the show-ring type. His colour was yellow and white, and he bore out, to a great extent, the theory that the Guernsey has been used in the making of the Ayrshire breed. He proved himself a very fair sire from a dairyman's point of view when mated either with pure-bred Ayrshires or cross-breds. (See photograph No. 6.)

Cornish Boy (imp.), by Fireball, from Gertrude 13th. Bred by William J. Hoskin, Loggan's Mill, Hayle, Cornwall.

Cornish Boy was in high condition on his arrival in this State, and gave evidence, from a flesh point of view, of being inclined to beef rather

than milk. When mated with cross-bred cattle, or with Shorthorns with a stain in their pedigree, he was fairly successful in begetting good milk-yielding progeny.

Island King, by King of Stroxton, from Fanny 78th (imp.).

Island King was sired in England. His mother was a good dairy cow, having yielded 49 lb. milk, testing 3·9 per cent. butter fat in one day, and 7,060 lb. milk, equal to 310 lb. commercial butter, in eight months, through a dry season on grass food.

Dora's Boy, by Cornish Boy (imp.), from Lady Dora (imp.).

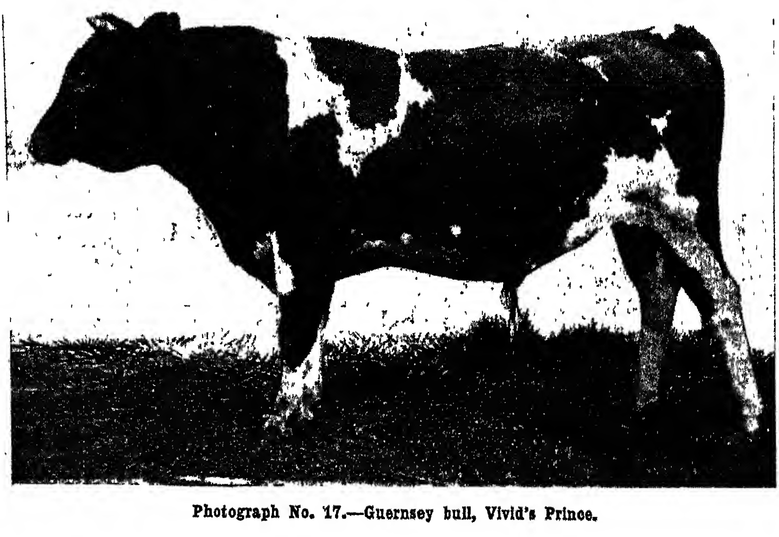
Dora's Boy, as can be seen by his dam's records, is extremely well descended for milk on the mother's side. Not many of his progeny are yet milking, and hence we cannot say whether he is successful in begetting milk to a large degree; but he has all the characterictics of a good type of Dairy Shorthorn.

Prince Royal, by Curly Prince, from Rosy 5th.

This bull has proved himself to be an extremely successful sire from the point of view of begetting heavy milkers.

Vivid's Prince, by Rose Prince (imp.), from Vivid (imp.).

This bull's mother yielded 7,985 lb. milk in a season, which tested equal to 459 lb. commercial butter, so he should be first-class from a dairy point of view, and he has proved himself able to beget heavy milkers. (See photograph No. 17.)



Photograph No. 17.—Guernsey bull, Vivid's Prince.

Note on the Occurrence of Manganese in Soil, and its effect on Grass.*

By F. B. GUTHRIE, F.I.C., and L. COHEN.

[*Read before the Royal Society of New South Wales, November* 3, 1909.]

A SAMPLE of soil was received during last month from the Secretary of the Dubbo Bowling Club, representative of a number of small patches occurring throughout the green on which the grass had died down during last winter. It is stated that the green was laid down five years ago, and for the first three years was covered with a splendid coat of healthy couch, but last winter and this winter it died in forty or fifty small patches, ranging from a few inches to 2 feet in diameter. As the green receives the same treatment throughout, and as both the soil and the climate of the district are admirably adapted to the growth of couch, the problem presented was an interesting one, especially as there was an absence of the sour condition and shallowness of surface-soil frequently associated with such infertile patches. A sample, typical of the soil over the remainder of the green, and taken from places within 3 feet of the dead patches, was also obtained. A preliminary examination showed that both the soils were very similar in chemical composition, but the fact was noted by one of us, Mr. L. Cohen, that manganese was present in the soil on which the grass died down, and was absent in the other. The following is the result of the analyses of these soils:—

EXAMINATION of Soil from a dead patch on Dubbo Bowling Green, forwarded, together with portion of the healthy soil, by E. R. Hawke, Secretary.

	Soil from normal portion.	Soil from part where grass dies off.
Reaction	neutral.	neutral.
Capillary power	9·3 in.; excellent.	6·6 in.; good.
	per cent.	per cent.
Moisture	1·76	2·09
Volatile and organic matter	5·79	5·10
Nitrogen	·063	·105
Total water-soluble salts	·039	·045
Lime (CaO) soluble in hot HCl	·324	·329
Do do in 1 per cent. citric acid	·249	·220
Potash (K_2O) soluble in hot HCl	·038	·037
Do do in 1 per cent. citric acid	·010	·011
Phosphoric Acid (P_2O_5) soluble in hot HCl	·122	·105
Do do in 1 per cent. citric acid	·030	·017
Oxide of Manganese (Mn_2O_3) total	·000	·254
Do do soluble in hot HCl... ...	·000	·022
Do do do in 1 per cent. citric	·000	·033

* The article on "Bare Patches," by L. Cohen, in February issue, refers to this paper. The matter is of so much importance to agriculturists that we now give the original.

The total manganese was determined by fusion of 2 grammes of the soil with sodium carbonate; the portion soluble in hydrochloric acid was determined in 10 grammes of the soil boiled for twenty minutes with hydrochloric acid of 1·1 sp. gr. In the determination of the citric acid soluble manganese, 100 grammes of the soil were shaken with 1 litre of 1 per cent. citric acid for twenty hours in a mechanical shaker at fifty revolutions per minute.

The only difference shown by the analysis of these two soils is the presence of manganese in the patches on which it is reported that the grass dies down in the winter. It is possible that manganese is present as traces in the other soils, but not in sufficient quantities to give an indication by the methods adopted.

A great number of experiments have been made of recent years, both in pots and in the field, to test the effect of such substances as salts of manganese, zinc, &c., on the growth of plants, particularly by O. Loew and his co-workers at Tokio, and others. A resumé of the work done, and references to the original papers, will be found in the Annual Reports of the Chemical Society, Vols. I–V. An excellent resumé is also given by G. Pollacci, L'Industria Chimica Anno 9, No. 5, page 65, March 10th, 1909.

On the whole, although the results so far obtained cannot be regarded as entirely conclusive, it appears that manganese compounds in the soil, in small quantities, exert a stimulating effect on the growth of many crops, but whether that effect is due to the direct action of manganese as plant-food, or to a secondary action upon other constituents in the soil, is not yet satisfactorily determined. Some chemists state that the presence of manganese is necessary to the growth of the plant, and that it is present in minute quantities in all soils. In the particular case of meadow-grass, G. Salomone (Le Staz. Sper. Agr. Ital., Vol. 40, p. 108) found that the pasture was greatly improved by the addition of small quantities of sulphate of manganese; 1 gramme of the metal per square metre (about 27 lb. of sulphate of manganese per acre) produced a more vigorous growth and of a darker green, the yield of hay calculated to the hectare being 760 kilos greater in the case of the plot which had received the manganese than in the other. The effect on other crops of small quantities of manganese will be found by consulting the references already referred to.

Mr. Cuthbert Potts, of the Hawkesbury Agricultural College, has also been conducting experiments in this direction, both in the field and in pots. Mr. Potts has experimented with wheat for hay in the field by manuring with 20 lb. sulphate of manganese per acre, applied after the seeds had germinated; and although the season was not a favourable one, and the figures are not conclusive, and in some cases the treated plots did not yield any better than the untreated, he finds that on the average the yield from the untreated plots is somewhat better. In the pot experiments, also, Mr. Potts reports a slight average increase with wheat, tares, and oats on treating the soil with ·001, ·002, and ·005 per cent. manganese sulphate. Oats are stated to show the greatest increase.

In larger quantities manganese compounds have been found to act as plant poisons. G. Salomone* finds, as the result of experiments in the field, that 50 kilogrammes of manganese sulphate per hectare (about 44 lb. per acre) produce the most favourable results in the case of wheat. Above this quantity the development of the plant is retarded and the proportion of grain and straw diminished. With 80 to 85 kilos per hectare the plants died before flowering, and with 90 kilos per hectare the plants only attained a height of a foot and then suddenly wilted. He finds also that the toxicity of the different salts of manganese increases in those in which it acts as an electro-negative element, being greatest in the manganates and permanganates.

A series of interesting experiments has been published by W. P. Kelley† of the Hawaii Experiment Station, into the effect of manganese upon the growth of pineapples. He finds that certain areas of the soil in Hawaii on which the plants do not develop, turning yellow in colour and producing inferior fruit, always contain excessive quantities of manganese compounds. Analyses of these soils show that those on which the pines become yellow contain on the average as much as 5·61 per cent. of manganese (calculated as Mn_3O_4) in the surface-soils as against 0·37 per cent. in the soils producing the healthy pines. In this case it is to be noted that both soils are highly ferruginous, containing over 20 per cent. ferric oxide, the good soil being of a red colour, while the infertile soils are black. He has shown a further interesting point which bears upon the question immediately before us, namely, that on soils containing an intermediate proportion of manganese (1·36 per cent. Mn_3O_4), the pines become distinctly yellow during the winter months, but sometimes recover completely with the return of the warm weather.

Although the quantities of manganese found in the poor soil examined by us is not nearly so great as that in the black Hawaiian soils (containing only ·245 per cent. calculated as Mn_3O_4), yet it is possible that the peculiarity noticed in this soil, that the grass dies down in the winter, is due to the same cause, namely, the presence of an amount of manganese not sufficient to kill the plants when growing vigorously, but sufficient to affect them when in a less vigorous state of growth. Aso‡ has also pointed out that the toxic effect of manganese salts on wheat and barley is greatest in the cold weather, the plants recovering themselves completely with the return of warm weather.

That the cause of the failure of the grass in these patches is due to the presence of manganese is only put forward as a suggestion. It is to be noted that the Dubbo soil is not particularly rich in iron, and that the soils do not differ in colour, both being of a brownish colour, becoming red on ignition. The peculiar fact that the grass showed no sign of the effect of the poison for

* Le Staz. Sper. Agri. Ital., Vol. XXXVIII, p. 1015, and Vol. XL., p. 97. In the first paper will be found a good bibliography of previous work on this subject up to 1905.

† Journal of Industrial and Engineering Chemistry, Vol. I, No. 8, p. 533 (August, 1909).

‡ Bulletin, College of Agriculture, Tokio, Imperial University 5, No. 2, p. 177.

the first three years is also noted in the case of the Hawaiian soils. W. P. Kelley (*loc. cit.*) reports that the first crop of pines showed but little yellow colour during the first twelve months when grown on the black soils. Later, however, the plants became yellow and refused to grow. The soil itself also appears to become darker in colour with the continued growth of the pines. He concludes from this that there is possibly some change brought about in the soil by the crop itself, resulting in a change in the state of oxidation of the manganese.

Speaking generally concerning what is known of the action of manganese in the soil, it may be regarded as proved that in small quantities it is beneficial to some crops, that in larger quantities it acts as a plant-poison, but whether this is due to the direct action of the manganese itself or to some secondary action on the soil-constituents is not established. A quantity of manganese which is toxic to some plants may be harmless towards others. Thus Aso (*loc. cit.*) finds that barley and oats are not affected by doses of manganese which are injurious to rice, and Kelley states that the soils which do not grow pineapples give good crops of sugar-cane. The toxic action is greatest in winter, and if the quantity of manganese present is not excessive the affected plants often recover with the warm weather. The compounds in which manganese plays the part of an electro-negative element are the most toxic, and it appears that some process goes on through which the manganese is converted in the soil from an originally innocuous compound to a more poisonous one, so that its presence is not noticed in the soils for the first year or two. This process is probably one of oxidation, as the higher oxides are found to be more toxic than the lower.

Corroboration of these results has been afforded by the examination of patches of land at Milton (South Coast) in which barley would not grow. Comparison of the manganese content of this soil and of adjacent land in the same paddock, on which barley grows satisfactorily, showed that in the case of the bad land a higher percentage of manganese was present. The quantities in both cases were again small, but larger in the bad soil both in the fusion, hydrochloric, and citric acid solutions. The amounts soluble in hydrochloric acid were 0·038 per cent. in the good soil and 0·087 per cent. in the bad, the amounts soluble in citric acid being 0·034 per cent. in the good soil and 0·062 in the bad. Judging from these results alone, which is perhaps premature, it would appear that couch grass is affected by a proportion of manganese which has no appreciable effect upon barley.

A further case of soil-poisoning, probably due to manganese, has been afforded by the examination of samples of soil from the Experiment Farm at Bathurst, on which wheat died down before reaching maturity. The soil on which the crop died was found to contain ·114 per cent. Mn_3O_4 (soluble in hydrochloric acid), as against ·026 per cent. in soil from the same paddock in which wheat grew normally. The sample of bad soil was found to contain small fragments ($\frac{1}{10}$ gramme to 1 gramme in weight) of a manganiferous iron compound of a black colour and very soft.

Trials of Methods of Soil Culture.

IN the *Agricultural Gazette* for June, 1909, reference was made to a paper entitled, "Australian Dry Farming: a New Method of Soil Culture," read by Mr. R. W. Peacock, Manager of the Bathurst Experiment Farm, at the Brisbane meeting of the Australian Association for the Advancement of Science, which has been the subject of much criticism; and it was announced that the Minister had directed trials to be carried out at some of the other Experiment Farms to compare the methods which Mr. Peacock advocated with those which had hitherto been proved to give the best returns under the conditions of the district. Reports of the results of these trials have now been received from the Managers of Coolabah, Wagga, and Glen Innes Farms.

Briefly, Mr. Peacock's recommendations were as follow:—

(1) Plough as soon as possible after the preceding crop has been disposed of, using mould-board ploughs, the aim being to break up the soil roughly and loosely and to encourage the coarser particles to remain on the surface in the form of crumbs or clods.

(2) Do not cultivate the ground between ploughing and seeding.

(3) Consolidate the subsurface by means of a "subsurface compressor"—a narrow steel bar attached to the hoe of the seed-drill, fitted with set screw and spring pressure.

Mr. Peacock considered that the aim should be to keep the dust at the bottom, the granules next, then the crumbs, and the clods on top. The advantages which he claimed for his methods were chiefly the production of a self-mulching surface, leading to the deepening of the soil; free access of rain; the prevention of evaporation, surface-rooting, germination of weed seeds, and erosion of undulating country—all tending to increase the yields; and that a considerable portion of the surface soil was thrown out of action, an equivalent of subsoil taking its place in plant nutrition.

Experiments at Coolabah.

The report received from Mr. Geo. L. Sutton, Manager of Cowra and Coolabah Experiment Farms and State Wheat Experimentalist, is as follows:—

"Some Experiments with Cloddy Surfaces at Coolabah.

"In accordance with the Hon. Minister's wish and instructions, arrangements were made early last year at Coolabah to test the suitability of the cultural method advocated by Mr. Peacock for practice in dry districts, of which Coolabah is typical.

"The experiment was arranged so as to ascertain and compare the yields obtained from ground broken down and brought to the recognised orthodox tilth, and from ground the surface of which was left loose after the plough, and in a cloddy condition. It is pointed out that the results are not those obtained from the trial of different cultivation systems, but the results of an experiment to determine whether in principle a cloddy surface is more favourable to plant growth than a tilled one. This was undertaken because any cultivation system must have been devised as the result of applying several or many agricultural principles to practice. A comparative trial of two cultivation systems would require to extend over several seasons. The facilities for conducting such a trial were not available either at Cowra or Coolabah.

"The trend of the experiment was determined by the fact that it was in this direction that the new system of agriculture differed from that previously practised.

"Facilities for such being available, the experiment was divided into three sections. In section A the crop was manured with a mixture of superphosphate 4 parts and sulphate of potash 1 part, at the rate of 75 lb. per acre. The previous crop was a fallow crop of tares grown in 1908, ploughed in, December, 1908. In section B the crop was manured as in section A, and followed a crop of wheat grown in 1908. In section C the crop was unmanured, and followed a crop of wheat grown in 1908. Details as to the operations and results obtained from the different sections of the experiment are as follow, and have been supplied by Mr. Kelly, who conducted the experiment from its initiation.

"SECTION A (G. I.)

"The ground in this section was cropped in 1908 with miscellaneous fallow crops, which were ploughed 6 inches deep in December, 1908, with the disc plough. After this the whole of the ground received the same treatment, viz. :—

December	12, 1908,	rolled and harrowed;
,,	28, 1908,	cultivated;
January	28, 1909,	cultivated;
February	6, 1909,	harrowed—

until 22nd February, 1909, when, for the purpose of this experiment, the block of ground was divided into three plots, as per plan A.

A.

1—*Cloddy.*
Buffer Plot.
2—*Tilled.*

"Plots 1 and 2 were 28 links wide, and were separated from each other by a buffer plot 14 links wide. Both plots had received the same treatment the previous year, and were of similar character and in uniform condition, with a rough surface and clods of medium size. On 22 February, 1909, plot 2 was rolled, cultivated, and harrowed to bring it to a fine tilth, plot No. 1 being left undisturbed with the clods of medium size. At this stage arrangements were made to take samples of soil periodically from both plots for Mr. Guthrie to determine their moisture content.* Plot No. 1 was re-ploughed 6 inches deep with the mould-board plough in readiness for planting on 3 May, 1909. By this time the weeds had made a fair growth in parts of the plot. From February 22, 1909, plot No. 2 was treated as follows, to maintain its tilth and conserve the moisture :—

February	22,	rolled, cultivated, and harrowed.
March	3,	cultivated (springtooth).
,,	4,	harrowed.
,,	18,	disc cultivated.
,,	20,	harrowed.
April	2,	cultivated.
,,	3,	harrowed.
May	4,	cultivated and harrowed.

"It will be observed that a considerable amount of cultivation was given to plot 2. This was done in order to make the contrast between the tilled and cloddy portions as great as possible, and not because such an amount of cultivation is necessary in commercial practice. In connection with this it is believed that in commercial practice the following operations could probably have been dispensed with without loss :—

February	22,	rolling and harrowing.
March	4,	harrowing.
,,	20,	,,
April	2,	,,
May	4,	,,

"On 4 May both plots were planted with Steinwedel wheat at the rate of 30 lb. per acre after No. 1 plot had been ploughed 6 inches deep with mould-board plough (Fish). At the same time, fertiliser at the rate of 75 lb. per acre was distributed by means of a drill, to the centre of which was attached a sub-surface compressor. Plot 2 was rolled and harrowed after drilling. On 15 May 35 points of rain were registered. The seed on the tilled plot No. 2 had germinated and the plants were well and evenly above the ground. On the cloddy plot No. 1 the plants germinated very unevenly, and in a great many places had failed entirely to germinate. On 20 May the tilled plot No. 2 was harrowed. On 24 May, after a further 12 points of rain had fallen, the growth on the cloddy plot was very irregular, whilst the growth on the tilled plot was splendid and very even, almost fit for grazing sheep on had necessity

* The results of these examinations showed that the surface soil of the tilled portion was uniformly moister than the same stratum of the cloddy portion.

demanded it. On 1 June all plots were progressing favourably, but still there was a marked difference in favour of the tilled one between the two plots. On 29 June, both plots were making rapid progress, but growth on the tilled plot was still in advance of that on the cloddy plot, being higher and thicker. The growth on tilled portion had completely covered the ground while generally the ground was still noticeable on the cloddy plot. On 9 July, the tilled plot was harrowed, the growth being much higher and thicker. On 1 September, the wheat on both plots commenced to come into ear, and at this time there was very little difference in the appearance of the plots. On 25 September, the plots appeared even in height, the tilled plot being a little thicker. A portion about ½ a chain long on the cloddy plot was not quite as forward as the rest, and was beginning to burn off.

"Both plots were harvested with the reaper and binder for hay. To admit of ready calculations, a piece from each end and from both plots was cut off, leaving an area of one-tenth of an acre in the centre of the plot, which was weighed with the following results:—

Yield of Greenstuff. No. 1 (cloddy).		Yield of Greenstuff. No. 2 (tilled).	
Per plot.	Per acre.	Per plot.	Per acre.
1,073 lb.	10,730 lb.	1,294 lb.	12,940 lb.
(4 tons 15 cwt. 3 qrs. 6 lb.)		(5 tons 15 cwt. 2 qrs. 4 lb.)	
Percentage yield.		Percentage yield.	
100		120	

"SECTION B. (J. II.)

"The ground utilised for this section of the experiment had been cropped with wheat in 1908 (which was harvested for hay in October), and, as far as could be judged, was uniform in character and condition at the commencement of the experiment.

"The block was divided into six plots, each plot 26½ links wide, as per plan B.

B.

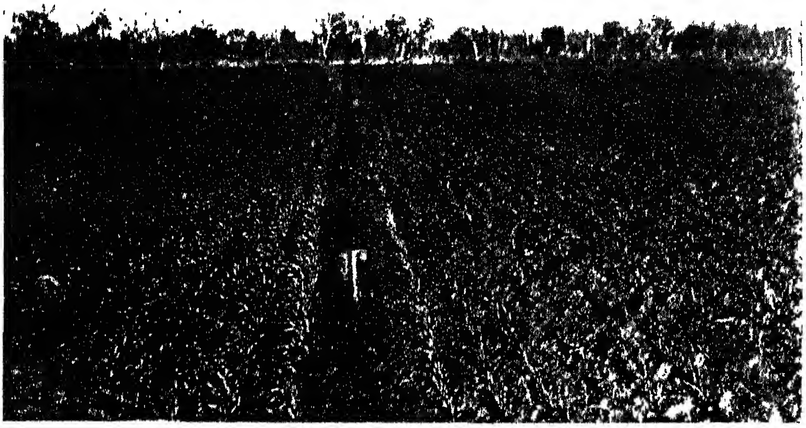
1—*Tilled.*
2—*Cloddy.*
3—*Tilled.*
4—*Cloddy.*
5—*Tilled.*
6—*Cloddy.*

"The plots were wide enough to admit of a strip twice as wide as the drill would cover being sown. All the plots were ploughed on 16 February, 1909, with the mould-board plough, 6 inches deep. Plots 1, 3, and 5 were then rolled, cultivated, and harrowed, to bring them to a good tilth. In order to maintain this tilth, these plots were worked until planting time as follows:—

Cultivated	3 March, 1909.
Harrowed	4 " 1909.
"	20 " 1909.
Cultivated	2 April, 1909.
Harrowed	3 " 1909.

"The alternate plots—2, 4, and 6—were not broken down, but were allowed to remain in the rough, cloddy state as left by the plough.

"On 3 May the cloddy plots 2, 4, and 6 were ploughed 6 inches deep with the mould-board plough (Fish), to prepare them for planting. On the same date the tilled plots were prepared for planting by being cultvated and harrowed.



Tilled. Cloddy.

Fig. 1. Section B.—Appearance of plots on 14th June, 1909, showing growth of plants and character of respective surfaces.

"On 4 May both series of plots were sown, by drilling, with Steinwedel wheat, at the rate of 30 lb. per acre; and at the same time fertiliser (superphosphate 4 parts, and sulphate of potash 1 part) was distributed at the rate of 75 lb. per acre. After planting, the tilled plots 1, 3, and 5 were treated as follows:—

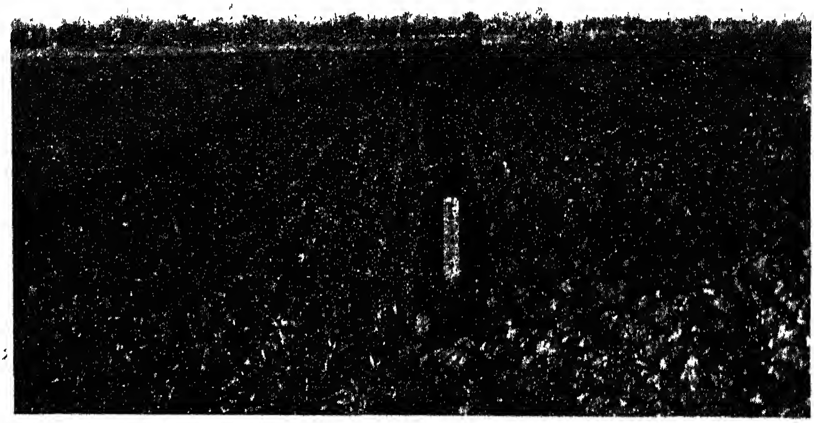
Rolled and harrowed immediately after planting on	4 May, 1909.
Harrowed	20 " 1909.
"	9 July, 1909.

"After planting, the cloddy section plots 2, 4, and 6 received no treatment until spring, when plots 2 and 4 were rolled and harrowed, plot 6 receiving no working. During the progress of the experiment the following notes were taken:—

"9 May.—The seed on the tilled plots has germinated fairly well, while that on the cloddy portion has only germinated in a few scattered places.

"15 May.—The plants on the tilled plots are up well and evenly, whilst on the cloddy plots the plants are only up in places. On this date 35 points of rain fell.

"24 May.—Twelve points of rain fell. The growth on the tilled plots is good and even, of 5 to 6 inches long, which could be used for sheep pasture. The growth on the cloddy portion is very irregular and patchy, and these plots have not nearly the quantity of green feed on them that the tilled plots have.



Tilled. Cloddy.

Fig. 2. Section C.—Appearance of plots on 14th June, 1909, showing growth of plants and character of respective surfaces.

"1 June.—All plots have made favourable progress, but still a marked difference in favour of the tilled plots is noticeable.

"29 June.—Crop on tilled plots is much thicker, higher, and more vigorous in appearance than on cloddy plots. The surface of the cloddy plots becomes dry much sooner after rain than that of the tilled plots.

"8 July.—The growth on the tilled plots is much thicker and more vigorous than on the cloddy plots.

"18 August.—The growth on the tilled plots is much better than on the cloddy plots, appearing generally to be 4 to 6 inches higher and thicker.

"1 September.—Growth on tilled plots is still much in advance. Plants on all plots coming into ear.

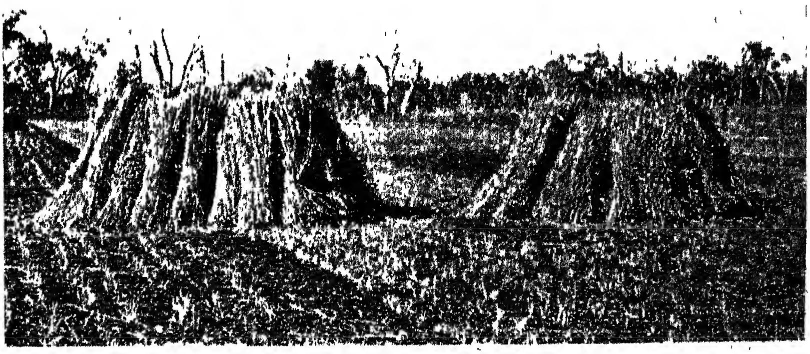
"The crop on all the plots was harvested on 5 October. At this time the crop on the tilled plots was more mature than on the cloddy plots, and the plants were about 9 inches higher. To admit of comparisons being made, an area one-tenth of an acre was harvested from the centre of each plot and weighed. The green weight was obtained by weighing the crop immediately it was cut with the binder. The dry weight was obtained by weighing the produce of each plot as soon as it was fit to stack, 20 October, fifteen days after cutting.

"The yields obtained were as follows:—

"SECTION B. (AREA HARVESTED $\frac{1}{10}$ ACRE).

Yield in lb.

No. of Plot.	Tilled Plots.				Cloddy Plots.			
	Per Plot.		Per acre.		Per Plot.		Per acre.	
	Green.	Dry.	Green.	Dry.	Green.	Dry.	Green.	Dry
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	1,140	551	11,400	5,510	......	...	....	....
2	.....	......	....	....	675	297	6,750	2,970
3	961	474	9,610	4,740	......	.....	... .	....
4	......	... .	....	....	660	285	6,600	2,850
5	800	394	8,000	3,940	......	......	... . ..	....
6	......	.....	....	....	599	271	5,990	2,710
Average ...	967	473	9,670 (4 tons 6 cwt. 1 qr.)	4,730 (2 tons 2¼ cwt.)	644	284	6,446 (2 tons 17 cwt.	2,843 (1 ton 5 cwt.)
Percentage ...	150	166	150	166	100	100	100	100



Tilled. (2 tons 2¼ cwt. per acre). Cloddy. (1 ton 5¼ cwt. per acre).

Fig. 8. Section B.—The yield of hay from the respective plots, 1-10th of an acre in area, 20th October, 1909.

"SECTION C. (K. II.)

"This section consisted of eight plots, arranged as per plan C, each 14 links wide. All the plots were under wheat in 1908, which was harvested for hay in October, yielding over 1 ton per acre. As far as could be judged the plots were uniform in character and condition.

C.

14 links.	1—*Tilled.*
14 links.	2—*Cloddy.*
14 links.	3—*Tilled.*
14 links.	4—*Cloddy.*
14 links.	5—*Tilled.*
14 links.	6—*Cloddy.*
14 links.	7—*Tilled.*
14 links	8—*Cloddy.*

A plot 14 links wide allows a strip the width of the drill being sown

"All the plots were ploughed 6 inches deep with the disc plough on 24–26 November, 1908, and were harrowed, rolled and harrowed in December, 1908, cultivated on 28 January, 1909, harrowed on 6 and 18 February, 1909. From this latter date until planting time the treatment varied in the two sections of the experiment.

"The tilled plots 1, 3, 5, and 7 were treated as follows:—

Cultivated	... ...	5 March.
Harrowed	... ...	20 „
Cultivated	... ...	2 April.
Harrowed	... ...	3 „

"To prepare the ground for planting the plots were cultivated and harrowed on 14 May.

"The cloddy plots 2, 4, 6 and 8 were not worked from 18 February until planting. Just before planting, these plots were ploughed 6 inches deep with

a mould-board plough (Fish) on 4 May. On 5 May, seed of Steinwedel was drilled in all the plots at the rate of 30 lb. per acre, and no fertiliser was used. After planting, the different sections received the following treatment: -

Tilled Portion.		Cloddy Portion.
Harrowed ...	... 5 May.	Harrowed in spring, 18 August.
" ...	... 20 "	
" ...	... 9 July.	
" ...	... 18 August.	

"The following notes were made during the progress of the experiment:—

"26 March. —Weeds are making rapid growth on the cloddy portion.

"11 May.—The seeds have germinated much more quickly and evenly on the tilled portion than on the cloddy portion. On this latter portion the germination is very irregular and backward.

"1 June.—The germination on cloddy plots is better, but still has a patchy and irregular appearance.

"29 June.—The growth on the tilled plots is still higher and more vigorous than on the cloddy plots.

"10 July.—None of the plots are making such good growth as section B, which was fertilised, but the growth on the tilled plots is slightly better than on the cloddy plots.

"2 September.—Growth on tilled plots better than on cloddy plots.

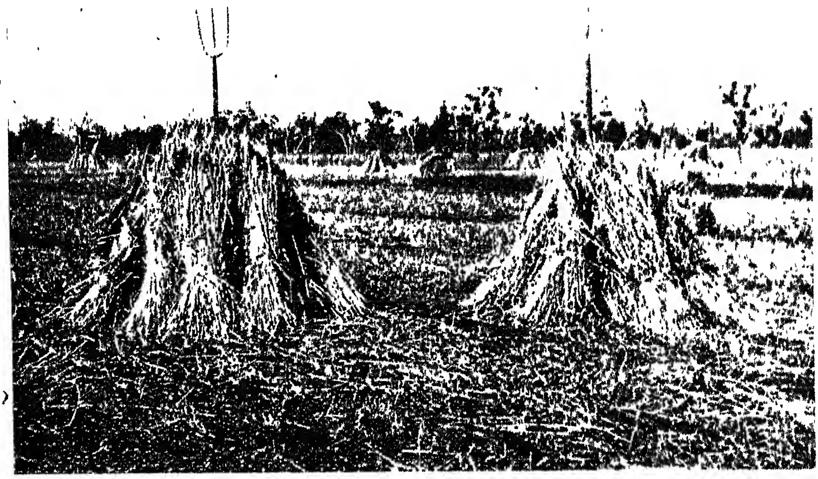
"The crop was cut for hay with a binder, on 6 October. A portion, one-thirtieth of an acre in the centre of each plot, was weighed for comparison. The green weight was obtained by weighing immediately after cutting, and the dry weight when the produce of each plot was fit to stack on 20 October—fourteen days after cutting.

"The yields obtained were as follow :—

"SECTION C. (AREA HARVESTED $\frac{1}{30}$TH ACRE.)

Yield in lb.

Plot.	Tilled Portion.				Cloddy Portion.			
	Per Plot.		Per acre.		Per Plot.		Per acre.	
	Green.	Dry.	Green.	Dry.	Green.	Dry.	Green.	Dry.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1 ...	165	76	4950	2280	...	...	....	....
2 ...	...	...	....	....	132	53	3960	1590
3 ..	174	81	5220	2430	...	...	....	....
4 ...	...	...	....	....	128	56	3840	1680
5 ...	200	98	6000	2940	...	...	....	....
6 ...	...	...	....	....	167	80	5010	2400
7 ...	262	138	7860	4140	...	...	....	....
8 ...	...	...	....	....	153	69	4590	2070
Average ...	200·2	98·2	6007 (53½ cwt.)	2947 (26¼ cwt.)	145	64·5	4350 (38¾ cwt.)	1935 (17¼ cwt.)
Percentage ...	138	152	138	152	100	100	100	100



Tilled. (1 ton 6¼ cwt. per acre). **Cloddy.** (17½ cwt. per acre).

Fig. 4. Section C.—The yield from the respective plots, 1-30th of an acre in area, 20th October, 1909.

" Summary and Conclusions.

" In every case the yield from the cloddy plots was less than that from the tilled plots. The difference in favour of the tilled plots ranged from 20 per cent. to 66 per cent. In the face of the results obtained there are no grounds for believing that, in dry districts, of which Coolabah is representative, the best results will follow from the adoption of a system which provides for the maintenance of rough cloddy surfaces, and which dispenses with such cultivation of the fallowed land as is necessary to reduce it to the generally recognised orthodox tilth, and to keep it loosely mulched.

" From a Coolabah standpoint, the rainfall during the growing period of the experiment was good, and amounted to 6·55 inches, as shown in the following table :—

" RAINFALL during growing period of crops at Coolabah under Mr. Peacock's method.

	No. of Points.	Total for Month.	No. of days' rain.
9 May	7	....	......
15 ,, ...	35	....	......
23 ,, ...	3	....	......
24 ,, ...	9	54	4
2 June...	158	....	......
3 ,, ...	5	....	......
9 ,, ...	15	....	......
10 ,, ...	12	....	......
11 ,, ...	1	....	......

"RAINFALL during growing period of crops—*continued.*

	No. of Points.	Total for Month.	No. of days' rain.
22 June...	13		
25 ,,	10		
26 ,,	1		
27 ,,	31	246	9
30 July...	45		
31 ,,	7	52	2
9 August	10		
10 ,,	15		
11 ,,	50		
12 ,,	40		
13 ,,	43		
20 ,,	71		
24 ,,	1		
29 ,,	45		
30 ,,	4	280	9
3 September	15		
9 ,,	1		
14 ,,	2		
17 ,,	5	23	4
	655=6·55 inches.	655=6·55 inches.	28

"From the beginning of the year until 31st October, the rainfall was 14·56 inches, the different falls being recorded as follows:—

"RAINFALL at Coolabah Experiment Farm for year 1909.

	No. of Points.	Total for Month.	No. of days' rain.
20 January	272		
21 ,,	2		
30 ,,	23	297	3
1 February	8		
15 ,,	8		
18 ,,	27		
20 ,,	33		
21 ,,	31		
24 ,,	12		
25 ,,	185		
26 ,,	3	307	8
8 March	22		
29 ,,	21		
30 ,,	2		
31 ,,	69	114	4
19 April	15		
26 ,,	41		
27 ,,	1	57	3
9 May...	7		
15 ,,	35		
23 ,,	3		
24 ,,	9	54	4
2 June...	158		
3 ,,	5		
9 ,,	15		
10 ,,	12		
11 ,,	1		
22 ,,	13		

"RAINFALL at Coolabah Experiment Farm for year 1909—*continued.*

	No. of Points.	Total for Month.	No. of days' rain.
25 June...	10	....	......
26 ,, ...	1	....	......
27 ,, ...	31	246	9
30 July...	45	....	.....
31 ,, ...	7	52	2
9 August	10	....	......
10 ,, ...	15	....	......
11 ,, ...	50	....	......
12 ,, ...	40	....	......
13 ,, ...	44	....	.....
20 ,, ...	71	....	......
24 ,, ...	1	....	......
29 ,, ...	45	....	......
30 ,, ...	4	280	9
3 September	15	....	......
9 ,, ...	1	... .	......
14 ,, ...	2	.. ..	......
17 ,, ...	5	23	4
9 October	1	....	......
11 ,, ...	17	....	......
12 ,, ...	5	... .	......
29 ,, ...	3	26	4
	1,456 = 14·56 in.	1,456 = 14·56 in.	50

"*Weed growth on cloddy surfaces.*—Beyond the fact that, as the results obtained disclose, the germination on the cloddy plots, under conditions of scanty rainfall, is not so rapid nor so good, nor the after-growth as luxuriant as on the tilled plots, our observations lead us to believe that there is no foundation for the contention that the adoption of cloddy surfaces is a factor in preventing weed growth. Cloddy surfaces seem to retard plant growth, but beyond this there seems no inherent value in a cloddy surface to check weeds or destroy their seeds.

"*The subsurface compressor.*—The results obtained by attaching this to one of the hoes in the centre of the drill and using it throughout the major portion of the planting on the farm were entirely negative. As far as could be seen it made no difference whatever in the germination of the rows affected."

Mr. Sutton supplied the undermentioned particulars of the estimated cost per acre of the tillage operations under the two methods. He points out that, as the object of the experiment was to determine whether the practice of maintaining a *fine* mulch (as opposed to a *cloddy* one), was wrong in principle, it was necessary after the initiation of the experiment to always maintain a *fine* mulch on the tilled plots of the experiment. This entailed additional operations—mainly harrowing after cultivating—which in commercial practice would not be necessary. The cost of the tillage on the tilled plots is therefore in excess of what the cost would be were the same principle applied to commercial practice.

" Experiments with Cloddy Surfaces, Coolabah, 1909.

" The estimated cost per acre of the tillage under the different methods

" *Section A.*

Operations.		Cloddy Plots.		Tilled Plots.	
	Before Planting.	s. d.	s. d.	s. d.	£ s. d.
1908. 12 December...	Ploughed	6 0		6 0	
12 December...	Rolled	1 0		1 0	
12 December...	Harrowed	0 6		0 6	
28 ,, ...	Cultivated	1 3		1 3	
1909. 28 January ...	Cultivated	1 3		1 3	
6 February ...	Harrowed	0 6		0 6	
22 ,, ...	Cultivated	......		1 3	
22 ,, ...	Rolled	......		1 0	
22 ,, ...	Harrowed	......		0 6	
3 March ...	Cultivated	.....		1 3	
4 ,, ...	Harrowed	......		0 6	
18 ,, ...	Disc cultivated	......		1 6	
20 ,, ...	Harrowed	......		0 6	
2 April ...	Cultivated...	......		1 3	
3 ,, ...	Harrowed	.. ...		0 6	
4 ,, ...	Cultivated	......		1 3	
4 ,, ...	Harrowed	.. ...		0 6	
4 ,, ...	Ploughed	5 0		... ..	
		——	15 6	——	1 0 6
	After Planting.				
5 May ...	Rolled	.. ...		1 0	
5 ,, ...	Harrowed	.. ...		0 6	
20 ,, ...	Harrowed	.. ...		0 6	
9 July ...	Harrowed	......		0 6	
			——	——	0 2 6
			15 6	......	1 3 0

" *Section B.*

Operations.		Cloddy Plots.		Tilled Plots.	
1909.	*Before Planting.*	s. d.	s. d.	s. d.	s. d.
16 February ...	Ploughed	6 0		6 0	
17 ,, ...	Rolled	......		1 0	
17 ,, ...	Cultivated	......		1 3	
17 ,, ...	Harrowed	......		0 6	
3 March ...	Cultivated	......		1 3	
3 ,, ...	Harrowed	.. ...		0 6	
20 ,, ...	Harrowed	......		0 6	
2 April ...	Cultivated	......		1 3	
3 ,, ...	Harrowed	......		0 6	
3 May ..	Cultivated	......		1 3	
3 ,, ...	Harrowed	......		0 6	
3 ,, ...	Ploughed	5 0		......	
		——	11 0	——	14 6
	After Planting.				
4 May ...	Rolled			1 0	
4 ,, ...	Harrowed			0 6	
20 ,, ...	Harrowed			0 6	
9 July ...	Harrowed			0 6	
August ...	Rolled	1 0		......	
,, ...	Harrowed	0 6		......	
		——	1 6	——	2 6
			12 6		17 0

"*Section* C.

Operations.		Cloddy Plots.		Tilled Plots.	
Before Planting.					
		s. d.	s. d.	s. d.	s. d.
1908.					
24 November ...	Ploughed	6 0		6 0	
24 ,, ...	Harrowed	0 6		0 6	
8 December ...	Rolled	1 0		1 0	
8 ,, ...	Harrowed...	0 6		0 6	
1909.					
28 January ...	Cultivated	1 3		1 3	
6 February ..	Harrowed...	......		0 6	
18 ,, ..	Harrowed...	......		0 6	
5 March ..	Cultivated	......		1 3	
,, ...	Harrowed...	......		0 6	
2 April ...	Cultivated	......		1 3	
2 ,, ...	Harrowed	......		0 6	
14 May ...	Ploughed	5 0			
14 ,, ..	Cultivated	......		1 3	
14 ,, ...	Harrowed...	......		0 6	
			14 3		15 6
After Planting.					
5 May ...	Harrowed...	......	......	0 6	
20 ,, ...	Harrowed...	......	......	0 6	
9 July ...	Harrowed...	......	......	0 6	
18 August ...	Harrowed...	0 6	......	......	
			0 6		1 6
			14 9		17 0

Experiments at Wagga.

Before commencing his experiments, Mr. G. M. McKeown, Manager of the Wagga Experiment Farm, paid a visit to Bathurst in order to ascertain by actual inspection the exact meaning which Mr. Peacock attached to the expression "a cloddy surface." He has now supplied the following report of the trials at Wagga Farm :—

"*No.* 1.—Paddock No. 2 had, the previous year, borne a light crop of rape and self-sown pasture, which was stocked with sheep until January, and then ploughed 6 inches deep and allowed to lie until April. It was then harrowed once, and part of it, viz., Block 1, containing 20¾ acres, was left with a cloddy surface, although its seed-bed had been compacted to some extent, by the passage of the harrow. The soil in Block 2, containing 21 acres, was further pulverized and compacted by rolling before sowing. The seed was then sown with a drill.

"The yield from the more thoroughly prepared land was 2 tons 10 cwt. 3 qrs. hay per acre, while the block left in rough condition returned 2 tons 6 cwt. 0 qrs. 13 lb. hay per acre. The blocks were exactly alike in quality of soil, and both were treated alike in all respects, except preparation.

"*No.* 2.*—Paddocks 1A, and 4—45 acres and 90 acres respectively, adjoin and are alike in quality of soil, the former having the advantage to

* Note.—This experiment may be disregarded as the conditions of manuring were not identical, and, therefore, the results are not comparable.—H. C. L. Anderson.

some extent over the latter in position, as part of No. 4 was affected by frost, which the former escaped. Both paddocks had borne grain crops the previous season.

"The soil in paddock No. 4 was brought into the finest possible tilth, while that in 1A was roughly broken, its condition, however, having been improved by harrowing once. Still the condition of the latter was that which we class as very rough. The condition of the soil affected the germination of the seed, the crop being ragged in appearance.

"No. 1A was manured with 62 lb. No. 1 superphosphate, while No. 4 was treated with 47 lb. per acre No. 3 manure. The former returned hay averaging 1 ton 7 cwt. 2 qrs. 16 lb. per acre, the latter averaging 1 ton 16 cwt. 2 qrs. 9 lb. per acre. Zealand wheat was used in all cases. The whole of the crops were weighed on the weighbridge.

"*No.* 3.—Paddock No. 5 had borne self-sown pasture the previous year, crops being annually alternated with pasture, and the latter fed off by stock.

"The land was ploughed late in May, and sown immediately. As good rains had fallen the soil, with very little working, was in excellent condition, free from lumps. An excellent rainfall was recorded for the month of June, viz., 304 points.

"The land in Block 1 was harrowed once, while, after the crop was up, Block 2 was further pulverised and compacted by rolling; but there was little difference perceptible in the condition of the respective blocks, owing to the rainfall as stated.

"Both blocks were sown with Comeback wheat for grain, the rougher cultivated portion, 19 acres, yielding 17 bushels 7 lb. per acre, the rolled block of 21 acres yielding 17 bushels 19 lb. per acre.

"The compressor absolutely failed to work in our soil, which, unlike that of Bathurst (which is gravelly), is fine, and very sticky when at all moist. The appliance, which, by the way, came in contact with only about one-fifth of the soil, when fitted to follow the drill-hoes through which the seed is deposited, brings the grain up and distributes it on the surface, leaving an open furrow behind.

"Unfortunately in all cases the land prepared as above was inadvertently harrowed once, and thus the seed-bed was more compact and the results from the rougher cultivation were better than they would have been if my instructions had been literally carried out."

Experiment at Glen Innes.

Mr. R. H. Gennys, Manager of Glen Innes Experiment Farm, found it necessary to make the trials with oats instead of wheat, as previous fallowing and continuous rains made it impossible to obtain a cloddy surface during the wheat-sowing season. The period between ploughing and sowing was only one week, which gave no opportunity of testing the effect of the two systems of fallowing as regards retention of moisture, growth of weeds, &c.

Moreover, during the period of growth 15·43 inches of rain fell. This is not "Dry Farming" at all. However, Mr. Gennys' report is published with the others for general information.

"Mr. R. W. Peacock's Method of Cultivation compared with that of Glen Innes Experiment Farm.

"According to instructions, I have endeavoured to get 1 acre of each method as typical as possible; owing to the nature of the ground through the season, however, this was very difficult.

"It was desired to make the trials with wheat, but through previous fallowing the land was in too friable a condition to obtain *clods*, being too fine even to suit us. After sowing wheat experiments continuous rains fell, which made the soil unfit to nearly obtain either conditions in our heavy soils. However, after a short dry spell in September it was determined to try and do the best possible to get a *fairly smooth surface* adjacent to a *cloddy one*. The trial was commenced after a maize crop taken off a few months previously, the White Tartarian variety of oats being used. The disc plough had to be used, as the mould-board would not work well in the stiff soils, and it was getting too late to wait longer. It will be seen that the difference in cultivation was two extra harrowings and one rolling. The difference in the results in value is shown hereunder, Mr. Peacock's method coming out the best; the sheaves, although less in number, weighed heavier.

"*Mr. Peacock's method.*

	ton	c.	qr.	lb.
593 sheaves, weighing	1	2	0	9

"*Farm method.*

	ton	c.	qr.	lb.
607 sheaves, weighing	1	1	0	18

"Difference in favour of cloddy system, 3 qrs. 19 lb., which, being valued at £2 10s. per ton in stack in same paddock, is approximately 2s. 4d. per acre.

"*Difference in expenses of each system.*

Mr. Peacock's method.	s.	d.	Farm method.	s.	d.
2 harrowings... ...	2	3	4 harrowings... ...	4	6
			1 rolling	1	1
	2	3		5	7

—the difference in favour of cloddy system being estimated at 3s. 4d. per acre.

"The total estimated amount in favour of Mr. Peacock's cloddy surface is 5s. 8d. per acre.

"*Remarks.*—Rainfall two months before sowing, 6 inches 84 points; rain during growth, 15 inches 43 points. Ploughing was done 24th September; sowing on 1st October; harvesting, 4th February.

"The scouring after heavy rains was only very slightly more on the Farm's plot (both plots were on a slight slope). In cutting the crop some of the clods and also the maize roots, as they had not been pressed in by the roller, interfered with the knife, which had to be raised occasionally to get over them ; this left a little more stubble.

"The crops had to be sown broadcast at the rate of 2 bushels to the acre. Germination occurred in both cases about the same time, and was very uneven."

Experiments at Bathurst.

Mr. Peacock was invited to supply a statement of comparative results obtained with his method as against the existing practices, for publication with the above reports. He has replied that his results will not be available for nearly another month, when he proposes to supply an article dealing with the Demonstration Area at Bathurst Farm, which has been worked solely upon the system he advocates.

Importation of Dairy Cattle into New South Wales.

The demand by the dairy farmers of this State for the use of the Government Guernsey bulls is so great that the Minister of Agriculture has decided to give our farmers further assistance in this direction, and with this object in view he has decided to import three or four more Guernseys, of strains distinct from those which the Department has at the present time. He considers that this would be a very favourable opportunity for farmers, either independently or in co-operation, to have bulls brought from England on their own account. The whole could be purchased by the one agent, and brought to New South Wales in the one ship, and under the one care, thus reducing the expenditure very considerably. Any farmers who contemplate availing themselves of this opportunity of importing cattle of any dairying breed should communicate with the Department of Agriculture as soon as possible, and submit their views and requirements to the Under Secretary.

Wheats at Shows.

Lest growers may be deceived in regard to the best varieties of wheats from results at shows, we wish to point out that under the conditions governing wheat exhibits at many shows it is possible for a very inferior yielder to obtain first prize, and still the award may be a correct one, as the wheat is often judged from the grain alone. Hence the fact that a wheat is a prize-winner may be no indication to the farmer that it is a desirable variety for him to grow. The Cowra Society has recognised this by offering prizes for the best variety judged in the field at harvest time, and according to a scale of points of which the lion's share is assigned for ability to yield well. Bags of the competing varieties are to be exhibited at the next show, and are to have attached to them the details as to yield and points awarded.

Irrigation at Wee Waa.

Mr. J. W. Doherty, of Wee Waa, has furnished the Department of Agriculture with the accompanying photograph of two patches of lucerne grown by him under irrigation upon his dairy farm on the black soil, situated on the fringe of the Pilliga Scrub, within 2 miles of Mr. R. Roden's "Cumberdeen" property, where experimental plots of wheat were recently grown

under the Department's supervision. Mr. Doherty obtained the water by pumping from a well 50 feet deep. The lucerne where the children are standing is four weeks' growth from last cutting, and that on the right of the picture, two weeks'. Mr. Doherty has rape and sorghum giving equally good results alongside.

Experiments with Red Oil.

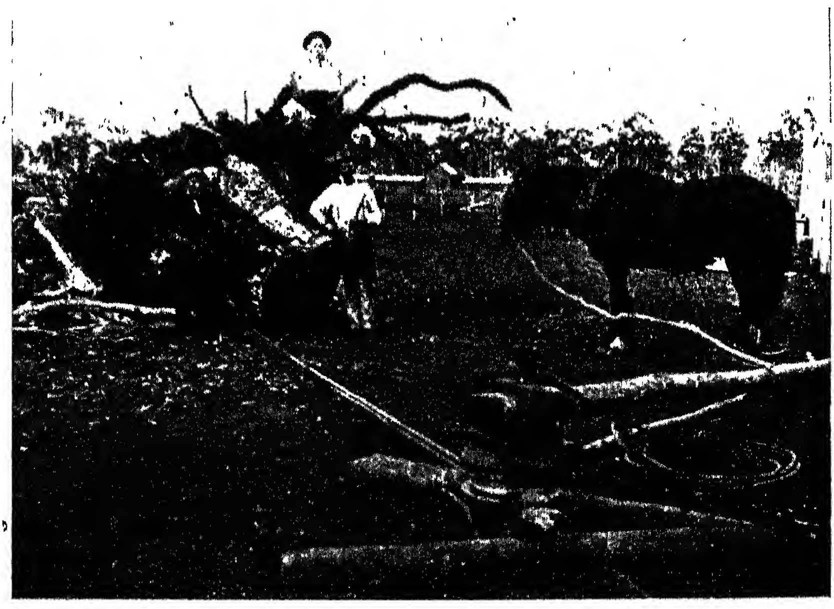
An application of red oil as a winter spray for woolly aphis was made to a number of apple-trees in the orchard of Mr. W. J. Moulder, Orangeville, Camden, on 6th July last, under the superintendence of the district fruit inspector, Mr. L. W. Nicholson. The spray was composed of 4 gallons red oil, 4 lb. soft soap, 192 gallons water. In connection with this experiment, Mr. Nicholson reports that he has received a communication from Mr. Moulder that it has been a complete success. In his letter Mr. Moulder states :—"I am well pleased with the experiment we made with red oil. I cannot see that it injured the trees at all. They are growing all right, and the blight has not come on again."

Smith's Grubbing Machine.

The Department of Agriculture recently accepted an offer on behalf of Messrs. M. Christiansen & Co., Liverpool, New South Wales, of a trial with "Smith's Grubbing Machine" at the Glen Innes Experiment Farm. The machine is worked by horse power, and its construction and operation may be seen from our illustration. The Farm Manager, Mr. R. H. Gennys, has furnished the following report on the trial:—

"I found Mr. Christiansen, who was in charge, 12 days' work at 8s. a day, allowing him one man at 6s. a day and one draught horse whose keep would be about 3s. a day.

"The work done in twelve days was approximately 11 acres.



"It is pointed out that the machine was not used on the new area being cleared, as that was already under contract, and it will be remembered that we have already bought a hand machine tree-puller; this answers well, but is not nearly so powerful as Christiansen's Horse Machine, and a great many of the roots must be grubbed before trees can be pulled. Many large trees were pulled by the large machine without any roots being cut, and few roots were cut even in the largest. For large stumps it is capital, for it not only pulls them over, but out of the hole as well. It is simple and expeditious. Visitors who have seen it at work appear well pleased, and it is likely some private sales will result. I think it will be very useful and save us much expense in clearing future areas on this farm.

"*Estimated Cost of clearing with Smith's Grubbing Machine.*

	£	s.	d.
Wages—1 man at 8s. per day and 1 at 6s. per day	8	8	0
Horse feed—3s. per day for approximately 12 days	1	16	0
Running roots for ploughing and filling in holes again at £1 per acre, 11 acres...	11	0	0
Cost of 11 acres	£21	4	0
Cost per acre	£ 1	18	6
Cost of clearing 1 acre in the ordinary way, by contract, approximately	3	2	6
Difference in favour of the Smith's Grubber, per acre	1	4	0"

In view of this report, the Department has purchased one of the machines, and a further trial is now being made at the Nyngan Experiment Farm.

Wheat Root System.

Arising out of a discussion at the Departmental Wheat Conference at Wagga in January last, Mr. R. W. Peacock, Manager of the Bathurst Experiment Farm, had an investigation made into the lateral and downward growth of the root system of wheat, sown in fallow and crop-bearing strips.

Mr. R. G. May, Experimentalist, reports that for the purpose a portion of the fallowed strip, 5 feet 6 inches wide, free from weeds, was selected. An excavation was made to a depth of 4 feet. Water was then sluiced on to the sides of this excavation to wash away the soil and leave the roots exposed. Owing to the colloidal properties of the stiff clay encountered, the amount of soil removed was not large, yet was sufficient to answer all requirements. From the crown of the wheat stubble to a depth of 3 feet 8 inches wheat roots were exposed, and at the centre of the fallowed strip, at a spot 2 feet 9 inches from each sown strip, wheat roots were found in large numbers.

Mr. Peacock expresses surprise at the depth the roots penetrated, the ground being a heavy clay below the first 8 inches. He considers this deep rooting due to preceding dry weather which, by causing the clay to crack and fissure, allowed the roots comparatively free access down the interstices. This opens up the interesting question of variation of root development during differing seasons.

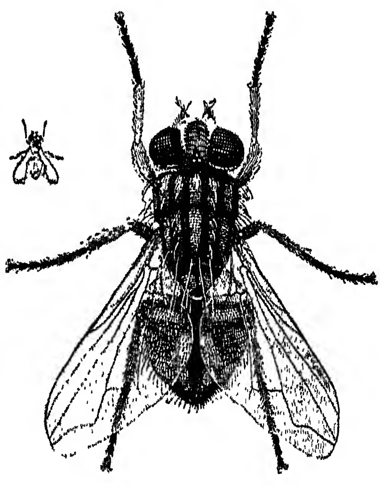
The lateral development, given as 2 feet 9 inches, may have been considerably greater, but could not be followed on account of overlapping from opposite plants. Mr. Peacock also points out that soil moisture would travel laterally a considerable distance to meet the feeding roots of a plant, thus bringing plant food with it. The plants would therefore gain sustenance from an area outside the actual root zone.

The House-Fly and the Diseases it Spreads.

WALTER W. FROGGATT, Government Entomologist.

No group of insects has received more attention from the hands of the naturalist during the last few years than the many species of flies.

These insects, belonging to the Order *Diptera*, are so called because, unlike most of the active flying insects, they possess only one pair of wings; the second or hind pair so well developed in other insects, as the hymenoptera, are replaced by a pair of tiny clubbed processes, that stand out on either side, and are known to entomologists as poisers, halteres, or balancers; and though these are of no use for flight, they assist in balancing the body when the fly is hovering over its food or visiting a flower.



The best known fly, and the one to which I intend to confine my remarks in this paper, is the common domestic house-fly; and, in spite of it only possessing one pair of wings, it is often much more active and difficult to catch than many another insect that has four wings. Now, in old days, the general opinion often stated in popular works on natural history was that the house-fly bred in and destroyed decaying matter of all kinds, and acted as a useful scavenger; in fact, so little attention was given to household insects, even in America, where so much work had been done in economic entomology, that when, as late as 1874, Dr. Packard started to write his paper on the development of the house-fly, and wanted to see authentic specimens, he could not find a single pinned specimen of the common house-fly (*Musca domestica*) in any of the natural history collections in the museums of the United States.

Growth of Medical Entomology.

The early entomologists turned their attention to the very necessary work of classification and study of museum specimens. Then, when entomologists began to study insects in the fields and forests, the science began to advance. In the middle of the last century, there were a number of scientific exploring expeditions fitted out by different countries. In these the doctors on the staff took up the work of the zoologist and made collections

in the various countries visited. This was a decided advance in the study of zoology in general, and entomology in particular.

When the question of tropical diseases came under the notice of the authorities, it was found that a course of zoology was essential to a medical student. In "Zoology and Medicine" (a most interesting paper on this subject—Smithsonian Report, 1906), Dr. Blanchard says: "As far back as 1883, the date when I had the honor to commence my teaching at the Faculty of Paris, the course of medical zoology was in reality only an elementary course of the Faculty of Science. This was by no means wholly bad, as we had to put into shape young people just out of college whose acquaintance with natural history was wholly inadequate; but it was necessary to supplement this elementary course by a detailed study of the parasites of animal origin."

Blanchard is one of the pioneers in the work of medical zoology, and his teachings have done a great deal to call the attention of workers to the close relationship of insects and diseases, which has culminated in the establishment of tropical schools of medicine in all parts of the world, and the equipment of scientific expeditions to study tropical diseases under the conditions in which they are contracted. Workers of all nations have taken up these studies, and medical entomology has become one of the most important and far-reaching branches of medical science, and the key to many mysterious diseases that puzzled the medical practitioner and defied his drugs.

Flies and Disease.

The subject is such a vast one that I shall confine my remarks to the rôle of flies in the spread of disease. Investigations carried out on these new lines have proved that many of the most deadly diseases that cause the untimely death of thousands of people are due to the presence of the *house-fly* and the *mosquito*. In the near future, when people are educated up to these facts, no civilised town will allow any filth to accumulate or remain uncovered to breed flies; and all tanks, drains, ponds, and swamps will be covered, or else treated so that no mosquitoes can breed in them.

Dr. Howard, of Washington, has proposed that we should drop the name "house-fly," with its harmless sound, and call it the "typhoid fly." While we talk about it as the domestic or house fly, we will never realise that it is the active agent in spreading typhoid fever. The subject is not a savoury one, but it is necessary to state plain facts in order to show how typhoid fever is spread. We all know how flies swarm over all kinds of food that are left uncovered—how they feed upon it by sucking up the moisture, or, if it is hard, how they discharge a little fluid down their proboscis to soften it. Not only do they feed upon all exposed food, but they discharge their excrement upon it; and then a thoughtless person eats this contaminated food that has been left in the pantry or on the dining-room table. Out in the yard and street swarms of flies may be observed resting and feasting upon every bit of decaying matter; from such things they come flying into the house, their feet and mouth reeking with filth.

Experiments carried out during typhoid epidemics, notably during the Spanish-American war, showed both means by which this disease was disseminated by flies. Under canvas, the cook's quarters were open, and the latrines were close to the hospital wards; the latter were sprinkled with lime at intervals. As the summer increased, the flies swarmed into the quarters where the food was kept, and the doctor in charge found many flies with particles of lime adhering to their feet, showing where they had come from.

Further examination of the excrement of these flies showed that it contained typhoid bacilli; so that the flies could, and did, contaminate the uncooked food, both directly from filth on their legs, and from their excrement.

Now, it has been pointed out that a man may be swarming with typhoid bacilli some time before he shows evidence of the disease, or is laid up, yet by the agency of the flies he is a centre of infection if the sanitary arrangements are unsatisfactory. There is far more typhoid fever spread by flies in this manner than from water and milk contaminated in other ways.

Another great danger from these insects is this: flies that have been feasting upon a dead beast where decay has set in, or upon a beast that has died from such deadly diseases as anthrax, &c., can, if they settle upon an open cut or fester (so common upon the bushman's hands in summer), cause blood-poisoning by inoculating the cut or sore with putrid matter, or with the deadly germs of anthrax.

The danger of not keeping all such cuts and festers covered cannot be exaggerated. "Barcoo rot," so well known to the western man, when every tiny scratch, or even broken sun-blister, festers and becomes a sore that will not heal, is probably caused by a germ spread by the action of flies.

Howard, in his bulletin ("Economic Loss to the People of the United States through Insects that carry Disease," Washington, 1909), has accumulated a great amount of evidence from all parts of the world relating to the deadly diseases that are directly traceable to house-flies, and he urges that everyone should do his utmost to destroy the breeding-grounds of the common house-fly.

He says: "Accurate scientific bacteriological investigations by Tizzoni and Cuttani in 1886 showed definitely active cholera organisms in the dejecta of flies caught in the cholera wards in Bologna, Italy. These observations were subsequently verified and extended by Simonds, Offelmann, Macrae, and others."

Dysentery is only too well known in Australia, and among young children, in particular, many deaths occur from this cause, particularly in the summer months. It has been shown in America and elsewhere that this intestinal disease is always most prevalent in the summer months, when flies are at their worst.

The house-fly is also known to have the power of spreading the bacilli of tuberculosis. Dr. Lord, of Boston, published a paper on this in the "Boston

Medical and Surgical Journal," in 1904, and Howard quotes his conclusions, of which the most important is that "Flies may ingest tubercular sputum and excrete tubercle bacilli, the virulence of which may last for at least fifteen days. The danger of human infection from tubercular fly-specks is by the ingestion of the specks on food."

The number of bacteria on a single fly may range all the way from 550 to 6,600,000. Early in the fly season the numbers of bacteria on flies are comparatively small, while later the numbers are comparatively large.

"The domestic fly is passing from a disgusting nuisance and troublesome pest to a reputation of being a dangerous enemy to human health," a distributor of typhoid fever, dysentery, cholera, tuberculosis, blood-poisoning, and other similar diseases.

The Breeding-grounds.

Therefore every naturalist and every doctor should know something about the life history of the house-fly, and where it breeds. When we have learnt this we can take means to destroy the material and refuse in which the flies can breed, a much more satisfactory method of dealing with the pest than by trying to destroy the active flies. The chief place in which house-flies deposit their eggs is horse manure. Any heap of horse manure piled up about a stable or yard will, within twenty-four hours, be found to contain swarms of small white naked maggots—the house-fly larvæ; on the second day these are full grown; on the third day they have changed to pupæ, and instead of white maggots, the more or less drying manure will be found full of oval reddish-brown cocoons, the pupal cases of the flies, from which, in three or four days, the perfect flies will swarm out ready to lay their eggs and carry on the next generation. This goes on all through the summer, so that, under favourable conditions, it is no wonder that flies become numerous. Packard placed a house-fly in a bottle at 6 o'clock in the evening, and at 8 o'clock next morning he found she had laid 120 eggs. How long a female domestic fly can live, and how many eggs she lays during her span of life, has not, as far as I know, been definitely settled. Though horse manure is the main propagating ground of the house-fly, and though all the flies, bred out of horse manure, that I have examined about Sydney are the true *Musca domestica,* yet Howard says: "Later investigations indicated that the fly will breed on human excrement and in other fermenting vegetable and animal material." Newstead, investigating the habits of the domestic fly in Liverpool, England, found that, besides horse manure, rubbish pits and also masses of used hops thrown aside bred house-flies.

A Cosmopolitan pest.

The house-fly described by Linnæus in 1781 is one of the most widely-distributed insects known, and there are few parts of the world from which this cosmopolitan fly has not been recorded.

The common flies are a pest in all the warmer portions of the globe, and in the East, among the Arabs and kindred races, the common cause of blind-

ness, purulent ophthalmia, is spread by the house-fly, and one of the most disgusting sights among the children around Cairo is to see the flies forming a regular fringe round their eyes and resting on their lips and teeth, without them taking the least notice of them.

In Captain Dampier's celebrated voyage round the world in the sixteenth century, he records his opinion of the natives on the north-west coast of Australia: "The poor winking people of New Holland. Their eyelids are always half closed, to keep the flies out of their eyes, they being so troublesome here that no fanning will keep them from coming to one's face, and without the assistance of both hands to keep them off, they will creep into one's nostrils, and mouth, too, if the lips are not shut very close. So that, from their infancy, being thus annoyed with these insects, they do never open their eyes as other people, and therefore they cannot see far, unless they hold up their heads, as if they were looking at something over them."

In South Africa, most of the explorers found the house-fly one of the most persistent pests, and Dr. Sparrman relates, in his travels, how they swarmed into his house in such numbers as to almost entirely cover the walls.

There are all kinds of queer legends about the common house-fly, and in most countries, particularly among the Eastern races, dreaming of flies denotes bad luck.

The doom of the house-fly is sealed when the public awake to the fact that it is such a dangerous inhabitant of our streets and houses; and in the near future, in every civilised city the doctors, entomologists, and sanitary officers will combine in the work of destroying its breeding-places, and it will become a thing of the past.

It is probable that Sydney is no worse than many other modern cities as regards fly pests, but there is great room for improvement, and anyone who has to go through the cross streets where the cleaning and salting of bullock hides is going on, with the bits of fat and scraps thrown out, and bloody brine running into the gutters, or where horses are standing and feeding at all hours, cannot fail to notice the swarms of blue bottles, blow flies, and house flies that are to be found all over such lanes and streets.

How many butchers' shops are there in the city that are protected against these flies with gauze wire, as they ought to be? Nearly every butchers' shop has the whole front open to the street, with the meat hanging out exposed to the flies, dust, and heat of a Sydney summer, even in our main streets. Not only do the street flies have the run of the butchers' shops, but the windows of the confectionery, small goods, and fruit shops are full of flies resting on the food, or flying in and out as they please.

Also around our fruit and vegetable markets, and most parts of Sydney where market commodities are sold, the same conditions exist, as far as the flies are concerned. Nobody seems to take any notice or comprehend the danger of buying food upon which flies have been resting or feasting, yet these flies are laden with the filth of the street on their legs and mouths.

Take any of the country towns; not only do all the well-to-do residents keep a horse, but most of the hotels run a livery stable in connection with their business, often so close to the windows of the dining-room that the energetic flies can swarm in from the manure heap (often accumulating for days in an open pit), where they have bred, and come romping over one's food and tumbling into one's tea.

The writer has a vivid recollection of one of his official trips to an up-country town in midsummer. He reached there at breakfast-time, and was taken to the local hotel, where, among the food upon the table, was a large open jam tart, simply black with countless numbers of feasting flies. Towards evening he returned to the same hotel and had tea; the remains of that jam tart were still on the dining-room table, and appeared to have been there all the day. It is needless to say that the flies were still skirmishing round it.

The fruit shops, confectioners' and small-goods shops are more dangerous than the butchers as germ distributors, because the food they contain is consumed without further cooking: and if anyone will stop to look into the ordinary shop where these commodities are sold, he will find a choice assortment of many kinds of flies buzzing round the windows trying to get out; yet no precautions are taken to exclude flies from these shops.

Though the tip of the city of Sydney is well looked after, there are some of the suburban ones that could be improved. In the majority of the country towns the refuse is usually simply carted out of the town limits and dumped down in some corner of the common or water reserve, and is a medley of rusty tins, old clothes, broken china, and decaying matter of all kinds, festering in the sun. The remains of the canned food left in the emptied tins is sufficient alone to produce germs enough to infect the whole township.

A suburban resident purchasing a load of fresh horse manure from some stable to mulch his roses, can often, at the same time, obtain in it enough flies (in the pupal state) to overrun his house with this pest, while he wonders where all the flies are coming from. A stable of any kind in the suburbs is a centre from which house-flies are often bred in sufficient quantities to infest all the adjacent residences. Until much more stringent rules are enforced by the inspectors of nuisances of the different municipalities concerning the storage and disposal of horse dung, flies will always be a menace. If, however, all stable manure is cleaned up every morning as it ought, and placed in covered receptacles until carted away, there will be no flies even in that stable; and until such methods are adopted, we will not get rid of the house-fly.

Remedial Measures.

When, however, they are in the house, there are many methods by which they can be kept down with fly-papers, fly-traps, &c., though most people seem to have an objection to trapping and removing dead flies, and the housewife has an objection to finding dead flies "all over the house."

A poison that will kill on the spot is, therefore, to be preferred, and in formalin we have such a poison. Take a soup-plate, and cut a couple of sheets

of thick blotting-paper to fit into the bottom; and sometimes half an inch of clean damp sand under the blotting-paper will help to retain the moisture on a hot day; saturate the paper with water, and sprinkle it over first with sugar, then with about a quarter of a teaspoonful of formalin (diluted with a spoonful of water so that it will spread all over the exposed surface). Place the plate in a well-lighted spot, on the floor for preference, and the flies, attracted by the sugar, are quickly killed by the formalin, and usually drop dead on the side of the plate. Formalin, however, evaporates after a time, so it may be necessary on a hot day to renew the dose at intervals.

Flies must have moisture, and, therefore, if a room full of flies, from which all water has been removed, is shut up for a couple of days, or even less in summer, every fly will be dead when it is reopened.

Fumigation is a very easy method of clearing a room of flies in a modern house, where all outlets can be closed. A number of different chemicals can be used; and though some of the chemicals are deadly poisons, and the fumes also poisonous to inhale, yet with ordinary care and precautions, there is comparatively little danger in using them.

Hydrocyanic acid gas generated in the same manner as we use for fumigating scale on fruit-trees in a closed room is sudden death to all flies. One ounce of cyanide dropped into 3 oz. of water, to which 1 oz. of sulphuric acid has been added, will give off enough gas to poison 200 cubic feet of space.

If the windows are previously unlatched, so that they can be opened from the outside to let the fumes escape after they have been confined for half an hour, there will be no danger from the remains of the fumes in half an hour after opening up the rooms.

Another mixture used with success for flies and mosquitoes in America is carbolic and camphor. A pound of carbolic crystals is dissolved by placing the bottle in hot water. While liquid, it is poured over 1 lb. of camphor, which is first broken up into small bits. The resultant mixture is a thick yellow liquid, which is securely bottled up, and must not come in contact with the skin. An ounce of this, placed in the room (in a shallow dish upon a stand, under which is a spirit-lamp to evaporate it), will kill all flies in the room. Three ounces will fumigate 1,000 cubic feet. The best method to use sulphur for fumigation is to mix 1 oz. of powdered charcoal and saltpetre with 8 oz. of flowers of sulphur, and then wet it with gum-water and mould it into a cone or pastile. One of these 9-oz. pastiles, when lighted in a closed room, will fumigate 1,000 cubic feet of space.

Ordinary insecticide, if sprinkled along the window sills will kill all the house and blow flies that get amongst it when buzzing round the window.

In most of the better-class houses in the country wire-gauze windows and doors are in general use for excluding both flies and mosquitoes, while many of the land-holders' homesteads have the broad verandahs rendered fly-proof with gauze-wire.

The use of wire doors and windows in Sydney is not usual, for many of the houses are not built so that they can be easily fitted, and many people think that the air does not circulate through the house as well as when the windows are free.

The first thing, however, is not to let the flies breed; and as soon as their breeding-grounds are closed down, and the material in which they breed is treated so that no flies can get out if the eggs have been laid in it before it is collected, the plague of flies will soon come down.

While the domestic fly is the common house insect in the out-back country and bush lands, it is the smaller species, *Musca corvina* (also cosmopolitan in its range) that is the great pest of the bush. It torments man and beast from sunrise to sunset all through the summer months. In the interior, from the first glint of morning sun till darkness falls, one is enveloped in a swarm of flies that nearly drive one crazy. Every bushman wears a fly-net round his hat, and the old sundowners, or swagmen, coming in from "out beyond" will often have a ring of strings, to which are attached little bits of cork that, swinging to and fro, keep the flies out of his eyes.

In these days of scientific sanitation it is surprising that our civic authorities have not taken up the most important question of destroying the breeding-grounds of the house-fly, now that its habits, life history, the food supplies of its larvæ, and the danger to man from its presence are so well known.

The expense of seeing that all householders who accumulate material in which flies breed, cover over such matter so that flies cannot gain access to it, until it can be carted away to the tip, or treated for garden manure, would well repay the outlay. It would also be necessary to see that all decaying matter is well buried, if not burnt at the tip; and that suburban residents and nurserymen have receptacles or covered pits in which to keep their garden manure.

All open or box privies should either be abolished or enclosed, so that flies cannot gain access to them. All human excrement should be destroyed or covered at once; such matter, washed into the water-holes in the country, with the first rains after summer, has been often responsible for outbreaks of typhoid fever. Typhoid germs are more common than is generally imagined, and the swarms of flies are the chief agency in scattering them about.

In conclusion, I would again quote Dr. Howard: "Even if the typhoid or house fly were a creature difficult to destroy, the general failure on the part of communities to make any efforts whatever to reduce its numbers could properly be termed criminal neglect; but since, as has been shown, it is comparatively an easy matter to do away with the plague of flies, this neglect becomes an evidence of ignorance, or of a carelessness in regard to disease-producing filth which, to the informed mind, constitutes a serious blot on civilised methods of life."

Spraying

W. J. ALLEN AND J. G. R. BRYANT.

THIS operation is now looked upon by all progressive fruitgrowers as work which must of necessity be carried out, as they realise that a tree covered with scales and other pests can no more yield fruit which commands the attention of buyers than can an orchard where the cultivation, pruning, and manuring are left to Nature's sweet will. There are still, however, a number of growers who have not realised the importance of this feature of the work, and a certain percentage of fruit is lost annually, much of which, by the timely application of a spray, could, no doubt, have been saved. It must be distinctly understood that in ninety-nine out of a hundred orchards spraying is absolutely essential. Diseases may not occur every year; but experience has shown that they recur frequently, and in years of serious epidemics the profits from spraying are so great, that the grower can afford to spray regularly as an insurance against loss. The following are four operations upon which all permanent success in fruit culture largely depend, viz., cultivation, manuring, pruning, and spraying. Spraying is last, but not the least important.

In the treatment of pests and diseases, the principal point is what remedy to use. Then comes the point of applying it. The orchardist must identify the cause of his trouble, because, as a rule, insecticides are of no use against fungous diseases and *vice versa*. There can be no doubt whatever in the mind of up-to-date orchardists that the annual winter dressing of lime—sulphur, or Bordeaux mixture, is of a very great benefit to the trees. Most growers know (for seeing is believing) the great loss caused by injurious insects and fungous diseases; but only a few realise as yet that this loss is really a benefit to every up-to-date grower. For as it is known that this loss can be prevented by intelligent effort, it is only the won't-be-convinced, non-thinking orchardist who will not put spraying into practice. This gives the energetic and progressive man an immense advantage. The demand for inferior fruit does not pay expenses, because it has no chance of sale alongside the choice fruit. Spraying, of course, means work, and disagreeable work; but it pays for itself in the increased market price obtained for the fruit. However, the work must be done intelligently, or the time and labour are wasted. Thorough, intelligent spraying means the use of a good spray pump and outfit, and above all, a knowledge of the enemies to be treated, and of the remedies found to be most effective, their preparation, and the proper time for the application. Prevention of fungous diseases is possible; but their cure is hardly practicable. When failure occurs, it may generally be attributed to the lateness of the application. Spray in time, and study the subject fully. Spraying is not a cure-all. It will not bring

back life, nor restore the leaves after they have been eaten off by caterpillars. The best results are not obtained the first year, especially when spraying for the fungous diseases. Success will be found in spraying only by thorough attention to details. The spray must actually reach every point which it is intended to protect. In applying winter sprays a coarser nozzle can be used than for summer sprays, because the object is merely to form a complete coating of the spray over the wood. In summer spraying, however, an exceedingly fine, mist-like spray reaching every portion of the plant, and covering with minute dots, preferably no larger than a pin's head, every square inch of the foliage, is necessary.

The nature, causes, and remedies for pests and diseases are often very uncertain; therefore unscrupulous people attempt to make money by selling quack remedies. Be very careful, in buying mixtures, to obtain them from reliable firms only, and after they have been thoroughly tested.

Fungoid Diseases.

Most diseases of plants are caused by low forms of vegetable life known as fungi, which live upon and within the tissues of the higher plants. The main difference, other than size, between the fungi and the higher plants, is the lack of the green colouring matter so abundant in the higher order of vegetation. The methods of development in the fungi are often different to those of higher plants, and their microscopic size renders their study more difficult. The parasitic fungi spend the winter months mostly within the living and dead vegetable tissues, and during the early spring days send out small spores, which correspond to the seeds of the higher plants. These spores are disseminated by the wind and other agents from plant to plant. With favourable conditions as to moisture and warmth, the spores send out small branches, which penetrate into the living tissues of the higher orders of plants. By the application of a fungicide to a plant, we destroy the spores which have found lodgment upon it, and thus prevent the development of additional spores, which would cause disease. Just as long as the tissues of plants are covered with a thin, even coating of fungicide, very few fungi can develop upon them. Thus, if a fungicide is applied at regular intervals of about two weeks during the spring and early summer, most of such plant diseases may be held in check. A fungicide is a preventive, and its application should begin long before the disease has advanced far enough to manifest itself to any extent.

Orchardists should profit by the experience of former years, and when grape vines or apples are affected any year with black spot or other fungus disease, they should begin spraying with a fungicide the following season, long before the time of the appearance of the disease.

Leaf-eating Insects.

There is a great difference in the manner in which insects take their food. Some eat the leaves, while others suck the plant juices. Orchardists must know to which of these two classes a particular insect belongs to

know what remedy to apply. Insects which eat the leaves have their mouth-parts formed for biting off pieces of vegetable matter, and in this way eat their food in much the same manner as do the higher animals. The insects which suck the plant juices, have their mouth-parts formed into a beak, which is inserted into the plant tissues. Some of the best-known of the leaf-eating insects are the Codlin Moth, Vine Caterpillar, &c. These insects can be destroyed by a stomach poison (insecticide)—a poison which kills the insects when taken into the stomach along with the particles of food. We apply this class of insecticide to the plants, making no effort to apply it directly to the insects.

Scale Insects.

These are small, sucking insects, which must be killed by a contact insecticide, applied directly upon them, which will kill them by penetration and irritation. Hydrocyanic acid gas is also used, and has proved the most efficient.

Plant Lice.

These are the insects so common upon a great variety of plants throughout the early spring and summer. They may be green in colour or black, such as Green Aphis or Black Aphis. Some are red. Plant lice may or may not have wings. The most common form during the summer months are the wingless females, which produce living young; winged males generally appear in the autumn. Aphis are the most common form of plant lice, and the treatment for them is an external irritant insecticide.

Materials Used in Spraying.

Fungicides are materials used in destroying fungi, which are low forms of vegetable life causing disease in plants. Correctly speaking, the fungicide acts as a preventive of plant disease, by obstructing the germination of the spores of the fungi causing such disease. These spores grow upon the exterior portion of plants. If we cover the plants with a coating of a copper salt, such as bluestone, or other chemical injurious to the germination of the spore, the reproduction of the fungi is held in check.

Insecticides are those substances used in destroying insects. The materials used in spraying are divided into two classes: the internal poisons and the external contact irritants, known also as the internal and external contact insecticides. Internal poisons are only used for those insects that bite their food; and they kill because of their poisonous action. The external contact insecticides act by their penetrating and irritant qualities. These are used against all insects whose mouth-parts are formed for sucking.

Spray Pumps and Outfits.

The particular outfit to be selected for spraying purposes will depend altogether upon the amount and character of the work to be done. Numerous pumps are made for the special work of spraying. A pump simple in construction is to be preferred. No one outfit can be expected

to suit all the varying conditions of spraying. Hand-pumps should give great pressure with the least expenditure of power. All working parts should be made of brass, and easily taken to pieces. No type of spraying outfit is more widely used, or has given better satisfaction, than the barrel-pump. There are a great many different makes on the market, of which many are efficient and successful. They are mounted in a great many ways. An ordinary fifty-gallon whisky barrel forms an excellent and inexpensive tank for holding the spray. The pump, according to its design, may be inserted in the end or the side of the barrel. The barrel may be mounted, to suit the operator, on a slide, or on two wheels, or it may be placed in a cart.

Hose and Nozzle.

Nothing contributes more to success in spraying operations than good hose and nozzles. In ordinary spraying operations half-inch hose is generally used. Good three or four-ply hose should be bought. It never pays to use cheap hose in spraying, as they are subjected to a great deal of rough handling.

The couplings should be of a style readily adjusted, and everything must be kept tight to withstand pressure.

Nozzles.

One of the most important parts of the whole apparatus is the nozzle. Good results in the application of the spray mainly depend upon the efficiency of the nozzle. For general use the best nozzle is the Vermorel, or a nozzle of that type. The four most commonly used nozzles are as follow:—

The Vermorel.—This nozzle undoubtedly throws the finest spray of any. In its use the nozzle should be held quite near the foliage or branches, as the liquid is not thrown out with much force.

The Bordeaux.—This is a splendid type of nozzle. It has the advantage over all other spray nozzles in that the character of the spray is readily changed from a solid stream to a mist-like, fan-shaped spray. If there is any clogging of the nozzles, it is easily remedied by turning the handle, thereby forcing out the obstruction with the pressure of the pump.

The Cyclone.—The spray from this nozzle is conical shaped, similar to the Vermorel.

The Friend.—This nozzle is coming largely into favour.

Extension Rods.

The ends of the hose should be attached to extension rods of suitable lengths for the work. For all lengths above 6 feet a bamboo extension rod is recommended. This consists of a small brass tube, supported by a bamboo rod.

Taps.

On the extension rod a tap is generally placed for turning the liquid on or off. For this a half-inch wheel valve is the most convenient.

The Agitator.

All pumps should be fitted with good agitators. The proper agitation or intermingling of the spray liquid is one of the chief features in spraying, and unless it is thoroughly done, good results will not be obtained.

Care of the Outfit.

A spray-pump, like any other machine, will do good work, and last in proportion to its care. When a pump does not work properly, the cause of the trouble should be ascertained at once, and remedied, otherwise permanent damage may result. When a spray-pump is first received, its working parts should be carefully studied. After the pump has been used, it should be thoroughly washed out with warm water, as most of the spraying mixtures are highly corrosive in their action. The hose should also be thoroughly washed out, and especially after using oil sprays. Always keep the barrel filled with water when not in use, to prevent the wood from warping and hoops becoming loosened. With proper care the pump should last several years; the hose, however, will probably have to be replaced after one or two seasons.

Intercolonial Congress of Tropical Agriculture and Colonial Development.

An International Congress of Tropical Agriculture and Colonial Development will be held in Brussels in May next. It is being organised by the International Association of Colonial Agriculture and the Belgian Association for the Study of Tropical Agriculture. The International Botanical Congress will also meet at Brussels at the same time, and will take part in the proceedings. Brussels has been selected as the place of meeting mainly on the ground that an International Exhibition is being held there this year, and a large influx of visitors interested in the objects of the Congress is expected.

A communication has been received by the Under Secretary, Department of Agriculture, from the British Section of the Congress, asking for the co-operation of the officers of the Department by the contribution of papers relating to the subjects proposed by the British Section for discussion at the Congress. These subjects are:—(1) Rubber; (2) Cotton; (3) Tobacco; (4) Wheat; (5) Cane Sugar; (6) General Agriculture; (7) Forestry. An invitation has been given to the officers of the Department to write papers for the Congress.

Locusts in Australia and other Countries.

Farmers' Bulletin No. 29, by Mr. W. W. Froggatt, Government Entomologist, dealing with Locusts in this and other countries, and methods of destruction, is now ready, and will be sent free to those interested on application to the Under Secretary, Department of Agriculture Sydney.

Photo. by J. Fisher, Quandong.]

A plot on Cherrigorang.

Mr. Larkin is standing on the treated area, and the boy on the area untreated.

Experiments with Nitric Acid on Alkaline Soils in Coonamble District.

R. S. SYMMONDS, Chemist's Branch.

IN order to ascertain the effects of the direct application of nitric acid to soil impregnated with carbonate of soda, on the artesian area, arrangements were made early in June last by Mr. G. Valder, Chief Inspector, to carry out a series of field tests in the Coonamble district. The landholders displayed a considerable interest in these experiments, and assisted us in a very generous and practical manner by ploughing, sowing, fencing off the various plots, and conducting us free of charge from station to station on each occasion. Where it was found to be convenient the test was made on what is known locally as sterilised soil, *i.e.*, soil which has been irrigated by bore-water for some years and rendered infertile. One or two tests were made on soil which is only slightly affected. In each case check or untreated plots were sown on each side of the treated plots, which have, in each case, an area of $\frac{1}{100}$ (one hundredth) of an acre.

The nitric acid, at the rate of 600 lb. to the acre, was mixed with bore-water and sprinkled on the land from a perforated butter-box, which, though crude, answered the purpose fairly well.

Samples of soil were collected from each plot, and examined in the laboratory. The particulars, dealing with each plot separately, will be found below. The tabulated results of the chemical and mechanical analyses will be found in the *Agricultural Gazette,* December, 1909, page 1106.

Speaking generally, the soils in the Coonamble district may be classified as (1) black clay, (2) brown loam, (3) gravelly sand. It was very noticeable that the injurious effects of the water on the black soil are slight when compared with the injury done to the brown soil and gravelly soil; and it is well to consider the following points in order to understand the nature of the injury referred to:—(1) Nature and depth of soil; (2) amount of lime and organic matter in the soil; (3) acidity or reaction of the soil; (4) quantity and nature of the saline substance in the water.

Some of these soils (the brown loam and gravelly sand) in a virgin state are generally acid to litmus paper, and are very friable, but under irrigation by bore-water in a few years they become very hard and impervious to air and water. There can be little doubt that this difficulty is due to the colloid constituent of the soil being in a diffusible condition, which then fills the interspaces with a jelly-like substance, and thus immensely increases the resistance offered to the passage of water. This condition is brought about by (1) the carbonate of soda, which neutralises the natural acidity and converts the clay and iron into diffusible colloids, and (2) the cementing and

hardening action of the silicate of soda contained in the water, and that which is produced in the soil by the action of the soda on the finely divided silica contained therein. In such a soil roots quickly suffer for lack of air, the process of nitrification cannot go on, and, what is even worse, the nitrates already present in the soil before the puddling occurred may be lost by the

Fig. 1.—A plot on Quambone.

Fig. 2.—Another plot on Quambone.

process of denitrification. This, in my opinion, is the cause of so many failures where bore-water has been used for irrigation, and our thought and energy should be directed to the supply of nitrates, and to produce and maintain a friable condition of the soil.

Nitric Acid Plots.

Two plots were marked out and treated with nitric acid on Yuma, the property of Mr. J. Landers. Soil, sample No. 1, was taken from the land before the acid was applied.

On 7th July, 1909, Mr. Landers reported as follows:—"I planted the seed the day after you left, but I think I sowed it too deep, as it has come up badly. I ploughed it in about 6 inches deep."

The seed did not germinate. A new combination drill and plough was the true cause of Mr. Landers' great disappointment.

Fig. 3.—Another plot on Cherrigorang.

Fig. 4.—Showing junction of treated and untreated plots on Darnley Chase.

Two plots were put in on Wingadee, and on 30th June the manager (Mr. M. Feehan) reported as follows:—"I saw Buckley the other day, and he tells me that there was a noticeable change in the plot you treated with nitric acid a few days afterwards." On 21st August, Mr. Feehan reported:—"I sent Buckley to report on it, and he tells me that the part that was previously under corn is doing better than the land that was under lucerne. In regard to the plots treated by you, Buckley says that neither plots are any better than the surrounding parts of the crop."

On the 12th of September, Mr. Feehan again reported:—"The experiment plots at No. 4 bore have now quite distanced the rest of the sown land. Buckley tells me that the growth on the ground you treated is very vigorous, and the wheat is of a nice dark green; other parts of the crop look poor and yellow."

Later in September Mr. Reynolds and I inspected these plots, which then looked very promising, there being a very marked difference in favour of the treated plots. We collected a sample of soil from one of the treated plots for examination, and to compare with the untreated soil.

Fig. 5.—Darnley Chase, untreated.

Fig. 6.—Darnley Chase, treated.

The following results were obtained:—Water capacity, 46 per cent.; capillary power, 5·2 inches; nitrogen, ·098 per cent.; lime, ·335 per cent.; potash, ·328 per cent.; phosphoric acid, ·144 per cent. These figures should be compared with those of soil sample No. 3, Table A (p. 1117, *Agricultural Gazette,* December, 1909). It will be noticed that the water capacity and capillary power have been considerably increased by the treatment, due probably to the coagulation of the diffusible colloids by the acid. The cylinder test supports this conclusion in a very striking manner. It will also be noticed that the nitrogen content, as well as the lime and phosphoric acid, have been increased; the potash is lower.

One plot was put in at Otterndorf (No. 6), on the land from which soil sample No. 6 was collected. Mr. Parkinson, on 25th June, reported as follows:—"I had the wheat sown on 7th June, and it all germinated in a few

days, and at the present time it all seems of equal growth. I noticed when breaking up the ground the fertilised portion was much more friable and broke up much finer than the other portion."

Mr. Parkinson, on 22nd August, reported:—"I have just returned from inspecting the plot, and I notice a great difference between the treated and untreated portions. The treated portion is far in advance, and the growth much more vigorous." Again, on 12th October:—"In reference to the plot, I put the bore-water on the day after your visit, and we have had two falls of rain since—small ones—but the plot has improved considerably, and is looking well."

One plot was put in on Darnley Chase. On 15th August, Mr. F. Stewart reported:—"The wheat is coming on splendidly, and there is a marked difference between the treated plot and the other. The treated plot was a little slower coming up—about three days longer—but it soon caught up and passed the other, and every seed I think germinated, whereas in the untreated lot only about half the seeds struck. I feel certain that you would be quite satisfied with the experiment if you saw it so far as it has gone." Mr. Stewart applied the acid to the plot himself, and carried out the various operations in a very satisfactory manner.

Three plots were put in on Quambone Station, one on the land from which soil sample No. 12 was taken, one from where soil sample No. 11 was taken, and one from the spot where soil sample No. 13 was collected. On 31st August, Mr. J. Broatch reported as follows:—"The experiment plot at No. 1 was sown on the 22nd June. On the 30th it was just showing through the ground. The untreated plot adjoining, sown on the same day, did not show through the ground until the 4th July. The treated plot is very much more advanced than the untreated plot. The treated plot shows every indication of giving a good yield, while the untreated plots will give a fair yield. Plots at No. 3 bore, sown on same dates, show the treated plots very much in advance of the untreated. I am afraid the untreated plots here will come to nothing, while the treated plots give good promise. Germination at No. 3 plots was about ten days later on the untreated plots than the treated ones; on the untreated plots only about one-third of the seed germinated." (See figures 1 and 2.)

At Cherrigorang two plots were arranged. Mr. Larkin went to considerable trouble and some expense in fencing off these plots. He erected a proper wire fence and wire-netted each plot in, carried out his instructions in a very satisfactory manner, and is very pleased with his results, which are very satisfactory indeed. On 27th June he wrote a letter, from which I have taken the following:—"I sowed the plots on 10th June, the day after you left; the treated plot was in very much the best condition when sown; you would have been pleased to have seen it the morning after you treated it—the lumps were all melted down like newly-slacked lime. As regards the germination, on 21st June I noticed odd plants on treated portion showing over ground. It is all up now, but very much much in favour of treated plots. I had to loosen the surface of the untreated plots to let plants come through."

On 28th August, Mr. Larkin reported as follows:—"Yours of 17th to hand, inquiring how the experiment plots are getting on. Well, there is now a very decided difference. The treated plot near the house is so rank in growth that it is going down; the plots in the loamy land show the greatest difference. The untreated plots are making very poor growth; the treated plot is making splendid growth. This land has been irrigated every year since I got the bore."

From what I have seen of these field tests, I am satisfied that the proposal to apply nitric acid to the soil and water is a sound one. At the same time, with a highly technical scheme such as this is, many difficulties will have to be overcome, though at the present moment I do not see any legitimate reasons why the mineral substances in our artesian waters should not become a valuable asset.

Mr. F. Howles, M.Sc., who has thoroughly investigated the question of manufacturing nitric acid from atmospheric nitrogen on commercial lines, says:—"The cost of production per ton of calcium nitrate, containing 13·2 per cent. of nitrogen, is £4, when produced by the Birkeland-Eyde process. The principle of the Birkeland-Eyde arc was demonstrated by means of Ruhmkorff coil and an electro-magnet. The spark discharge was passed between the poles, and at right-angles to the field of the electro-magnet. By this means the spark flame is caused to spread out into a disc. The hot gases from the electric furnaces pass first through a steam boiler, where they give up part of their heat to raise steam. Then they enter at 50 degrees C. the absorption towers, which are about 50 feet high, built of granite slabs, and filled with lumps of quartz, over which the water trickles. In tower No. 1, 50 per cent. nitric acid is drawn off; in No. 2, 25 per cent.; in No. 3, 15 per cent.; and in No. 4, 5 per cent. nitric acid is drawn off. The liquid is transferred from tower to tower by compressed air. Tower 5 contains milk of lime; tower 6 is made of wood, and contains beds of dried quicklime. The 50 per cent. acid is added to limestone, and the solution concentrated until the residue can be poured molten into iron canisters."

According to the Journal of Industrial and Engineering Chemistry, published by the American Chemical Society, July, 1909, a considerable and important advance on the Birkeland-Eyde process has been made. Hofrat Professor Dr. A. Bernthsen says, *inter alia*:—"Otto Schönherr succeeded in 1905, in discovering, and, with the assistance of the engineer Hessberger, working out a process of producing an electric arc, and was thus enabled to solve the problem in a surprisingly simple manner, presenting considerable advantages over the method of Birkeland and Eyde. It is not a mere modification of their process, as has sometimes been falsely assumed, but differs fundamentally from it, for while Birkeland and Eyde cause the electric discharge to burn in a strong magnetic field, and thus spread it out in the shape of a flat, more or less circular, disc, Schönherr dispenses entirely with magnets and magnetic fields, and produces his arc inside an iron tube of comparatively small diameter, at the same time passing the air through the tube, and thus bringing it into contact with the arc. The gases leaving the

tube contain about 2 per cent. of nitric oxide, that is, from one and a half times to nearly twice as concentrated as the gases which Birkeland and Eyde produce.

"With the aid of Schonherr's invention, it is possible to send extraordinarily large quantities of electrical energy through a single tube. Even the small experimental apparatus which you see before you uses about 5·5 h.p. of electrical energy, and works with a tension of 5,000 volts.

"As you see, the apparatus is extremely simple, and at the same time very durable. Ordinary iron tubes are employed; there are no movable parts, and no expensive electro-magnets, and the manufacture runs smoothly.

"Nitrates can be obtained directly from furnace gases by employing *sodium carbonate* or milk of lime as the absorbing agent, and at the same time maintaining the temperature and other conditions."

There should be no great technical difficulty in applying this method of producing nitric acid to our alkaline artesian waters, which are in an ideal condition to absorb the gases. The waters contain the necessary carbonate of soda free of cost; the water is hot, which would assist the chemical change, and the costly process of concentration is quite unnecessary, as the nitrate could flow out with the water on the land. Taking the cost of producing nitrate of lime by the Birkeland-Eyde process at £4 per ton, and as this product is concentrated and the lime and power purchased, it is reasonable to assume that the cost of producing nitrate by Schönherr's process would be something less, particularly so, as it is claimed that this process gives a 50 per cent. higher yield of nitric acid. The cost of nitrating our artesian water would be lessened again by blowing the furnace gases directly into the hot artesian water.

Additional information regarding the sowing and harvesting of the plots is afforded by the reports to the Under Secretary of Mr. Inspector Reynolds, who is in charge of the farmers' experiment plots in the western division. The details are as follow :—

Yuma Plots.—The land was roughly ploughed, and the seeds were dropped in the furrows, and generally covered 6 inches deep. Only about 50 per cent. of the plants reached the surface, and the bare patches were subsequently resown. When the plants were well above ground, a good flooding was given with bore water containing 32·5 grains carbonate of soda per gallon. Two months after sowing, the portions of the plots treated with nitric acid were 6 inches higher than those not treated. Six weeks later, both had a good growth of strong plants, 3 feet 6 inches in height. One plot was cut out with the main crop for hay.

Wingadee Plots.—Two plots were sown at Wingadee early in June on sandy brown loam. The land was hard in each case, and broke up into large clods. The nitric acid made the soil more friable, and a better seed bed was thereby obtained. When the two plots were inspected nearly three months after sowing, a great difference was noticed in favour of the portions to which the nitric acid had been applied. The plants were from 9 to

12 inches taller, the growth was more uniform, averaging about 2 feet, while on the untreated portions there was irregular growth of from 6 to 18 inches; the plants were better in colour, the straw was thicker, and the flag broader. Want of water at a critical time caused the plants to wilt and die.

1 2 3

Fig. 7.—Samples of wheat from Quambone Station.

1. Wheat in ear, 3 ft. 9 in. in stem. A good average sample of a large field of wheat on brown sandy loam, never irrigated with bore water.
2. On same class of soil, but irrigated with bore water. This is the average growth on land treated with nitric acid.
3. Average growth on alkali land adjoining plot treated with nitric acid.

The three samples were growing within a few yards of each other.

Otterndorf Plots.—The land in these plots was a brown loam, with a stiff whitish subsoil 2 feet from the surface. The plots were ploughed 6 inches deep, the seed raked in, and no after cultivation or irrigation was given. The paddock in which the plots were situated was sown with lucerne six years before, and only a poor and weak stand is now left. For three years the lucerne did well, until diffusible colloids filled the interstices of the soil. As in the case of the Wingadee plots, the portions at Otterndorf treated with the nitric acid showed more vigorous and satisfactory growth, the plants being 9 inches taller, of better colour, and having more stools.

Darnley Chase Plots.—Here again the soil was a brown loam, which was ploughed 6 inches deep and sown with Bobs wheat in the end of June. The paddock was irrigated for the first time last year, and no bore water had been applied during the current year up to the time of sowing. When examined on 26th September the wheat was 3 feet high on the treated portions, and only 20 inches on that not treated, and the soil was more friable on the former. At the beginning of November the crop on the treated land was 3½ feet to 4 feet; on the untreated plots, 3 feet to 4 feet, and 2 feet 6 inches, and thinner.

Quambone Plots.—Soil, brown sandy loam and brown loam. The sandy loam was broken up roughly, and sown early in June. Eight ploughshares were broken ploughing 6 inches deep, the ground was so hard. No cultivation or water was given since seeding. On 26th September, on the treated

portion, the plants were taller, stooled better, and had a better colour; but eventually the plants on these plots all died for want of water. On the brown loam two plots were treated with nitric acid, one on irrigated land and one on land not irrigated. Seed was sown early in June. On the alkali land, treated and untreated, the growth was fourteen days later than on land not irrigated, perhaps due to better cultivation. Three and a half months after sowing the growth on treated land averaged 2 feet,

Fig. 8.—Rabbit-infested country, Coonamble District.
Darling pea, bindie, and black thistle—otherwise soil bare.

on untreated 1 foot. The land was flooded, and at the beginning of November the plots looked well, both treated and untreated, being 3 feet to 3 feet 6 inches high, in ear and healthy.

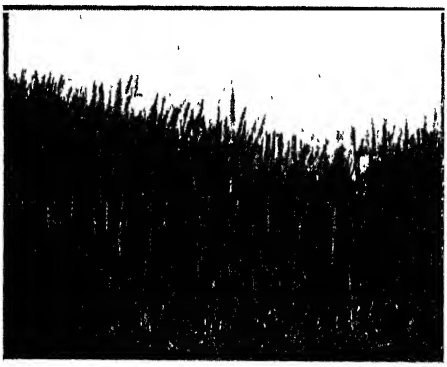


Fig. 9.—Mr. Stewart's, Darnley Chase.
From left—treated with nitric acid. On right—not treated.

Cherrigorang Plots.—Soil brown loam, more friable than at Quambone. The land was ploughed, seeded, and harrowed early in June. The untreated land had to have the surface broken with a pick to let the plants through. The difference in growth was more noticeable on these plots than on any of the others. Three and a half months after sowing, the growth on the treated plots was 2 feet 6 inches high, eight to twelve stems, dark green and vigorous; on the untreated plot, 6 to 18 inches high, two to six weak stools, light to yellowish green. The treated soil was somewhat more friable. Six weeks later the wheat on the treated plot was 3 feet to 4 feet high, the plants carrying many more ears than on the untreated plots;

Fig. 10.—Plot 1, No. 4 Bore, Wingadee.
From left—not treated with nitric acid. Taller portion on right—treated

Fig. 11.—Mr. Larkin's plot.
Front portion, untreated; remote portion, crop on treated land.

but the plants were demolished by birds.

Owing to the ravages of birds only one plot was saved on the black soil at Yuma; and on the brown soil, one at Darnley Chase for grain, and one at Quambone for hay, which gave the following results: Portion treated with nitric acid yielded at the rate of 2 tons $3\frac{1}{2}$ cwt. per acre; untreated portion gave a yield at the rate of 1 ton $11\frac{1}{2}$ cwt. per acre.

Lime on the Manning River.

There are few soils which will not derive benefit from the application of lime, even when this substance is present in fair proportion in the soil. It should be regarded rather as a means of improving the land than as a direct plant food. If a soil is chemically deficient in lime, this necessary ingredient will be supplied; if it is sour, it will be sweetened; a stiff clay soil will be lightened and rendered friable; a sandy soil will be consolidated. It is of special benefit to land which is destined for leguminous crops, or such crops as sugar-cane, maize, &c., which particularly require lime. In green manuring, the previous application of lime to the soil is of the greatest benefit in promoting the growth of the green crop.

Hence the Department has for years strongly recommended the use of lime on practically all soils. Ground burnt lime may be applied at the rate of 5 to 6 cwt. per acre in a manure distributor and lightly scattered over the surface; or freshly-slaked lime may be applied by breaking up the quicklime (stone lime) into smaller lumps and placing it in heaps about the field covered with moist loam. It is then left exposed to the air and moisture until it begins to crumble to powder, when the heaps are scattered with a shovel and the lime harrowed or ploughed in very lightly. Liming is most effectively done in autumn or winter, but whenever it is done the land should be left alone for two or three weeks after the application, and no seed sown nor manures used during that period.

Our readers on the North Coast will be pleased to learn that the Manning Lime Company have an immense deposit of limestone of excellent quality. At present the cost of distribution is heavy, as it has to be bagged and shipped by steamer, but when the railway is completed cheaper and better distribution will be possible. The Company have very kindly offered to supply the Department with lime required for experiments on the Manning.

Artesian Irrigation.

Fertilising Properties of Artesian Water.

R. S. SYMMONDS, Chemical Laboratory, Department of Agriculture.

THE development and successful utilisation of the natural resources of our artesian area, together with the solution of the various problems connected therewith, have a peculiar fascination for men of science; indeed it would be difficult to find a study more interesting to the investigator, or one more likely to yield valuable industrial results, thus adding to the power of mankind.

The study is one in which the biologist, botanist, chemist, engineer, geologist and physicist each play an important part, and their combined efforts should quickly improve those conditions which in the past have appeared insurmountable, and make this vast area so much more valuable.

When a bore is put down it usually passes through several water-bearing strata, each of which is sealed above and below by an impervious or water-tight stratum. This impervious stratum has apparently been produced by the alkali in the water acting upon the colloidal constituent of the clay and thereby converting it into a diffusible condition. The colloids thus produced are then squeezed together by the great pressure of the water until they become absolutely impervious and form a layer about 3 feet thick of very tough, dense, sticky clay, which, owing to its tenacious nature, presents considerable resistance to the progress of the drill during boring operations.

Until recently the practice has been to sink a well until a flow sufficient for requirements is obtained. The casing is then perforated or slotted opposite the various water-bearing strata to admit the water; the water from each stratum being allowed to mix to make up the quantity or flow. The water thus obtained is analysed and the saline contents returned as grains per imperial gallon.

In the Coonamble district of New South Wales, several shallow bore-streams contained over 50 grains of carbonate of soda per gallon. After flowing for years the bores have been deepened. I refer particularly to one on Wingadee and another on Quambone. The analyses made of these waters by Mr. J. C. H. Mingaye show that the carbonate of soda in the water from each of these wells has been reduced to about half since the water from the lower levels has been included in the flow; another very important feature is, that the water from these wells now contains potash and lime, both excellent fertilisers.

No attempt, so far as I could glean, had been made to analyse the waters from the various levels separately. The general idea has been to get quantity, and the quality as applied to agriculture has not yet been investigated. This is an important point, and in a measure, probably explains why some are successful for a longer period than others, when using the water for irrigation purposes. It is well to remember that the bores referred to on Wingadee and Quambone contain in their present flow the water from both the higher and lower levels. When we consider that the amount of soda in the water from these wells has been reduced by half, it is reasonable to assume that, by shutting off certain of the flows from the higher levels, the amount of soda in the water from these bores would be reduced to about 12 grains per gallon without reducing the quantity of potash and lime.

It would be a simple matter to collect a sample of water from each flow when sinking new bores, and by analysis ascertain which is the best water for irrigation purposes. Having determined that point, there should be no difficulty in shutting off the impure or highly mineralised water, as it is possible to shut off any or all of the flows. On the other hand, if it is imperative to have quantity, for a slight extra expense the water for stock could, by lowering and perforating the 8-in. casing, be brought up between the 6-in. and 8-in. casing, thus obtaining practically the flow of two bores. The fertilising water for irrigation purposes would then flow up the 6-in. casing, which could easily be arranged to convey the water to a separate channel.

In June last I made the above suggestions to the District Works Officer, Mr. P. C. Tibbits, who very promptly tested the theory in a practical manner on No. 2 bore, Coonamble, which was then in course of construction. This bore is situated about 37 yards from No. 1 bore and possesses all the conditions necessary to prove in a striking manner the great advantage to be derived by not perforating the casing opposite the water-bearing beds containing the high amount of soda.

Coonamble No. 1 Bore was carried to a depth of 1,302 feet. A small supply of salt water was met with at 114 feet, which rose to within 30 feet of the surface, and was shut off by 8-in. casing; another small supply was struck at a depth of 620 feet, which rose to within 70 feet of the surface, and at 822 feet a third small supply caused the water to rise within 60 feet of the surface. A flow of 14,292 gallons per diem was met with at a depth of 934 feet, 91,951 gallons per diem at 1,215 feet, and 362,260 gallons per diem at 1,302 feet. This is apparently the main flow feeding No. 1 bore, and has not been admitted into No. 2 bore. Owing to certain local conditions the flow of No. 1 bore is 315,090 gallons per diem, and has a temperature of 98 degrees Fahr. This bore was completed 10th September, 1893.

Coonamble No. 2 Bore was continued to a depth of 2,180 feet. During boring operations the same water-bearing beds were passed through as those enumerated in No. 1. At a depth of 1,587 feet a large flow of 943,490 gallons per diem was met and measured (the flows from the higher levels being shut out), and at a depth of 2,040 feet the final flow of 361,410 gallons per diem

was struck, which brought the total flow of the bore to 1,304,900 gallons per diem, the water having a temperature of 102 degrees Fahr. The casing was not perforated above the 1,450 feet level, in consequence of which the water supplying No. 1 bore is not admitted, the perforations being made at intervals to a depth of 2,100 feet. The water supply of this bore, No. 2, is drawn from the lower levels, and the analyses show that the sodium carbonate contained in it is only 7·189 grains, as compared with 40·00 grains per gallon in the water from No. 1. The sodium chloride is also reduced to 2·305 grains from 6·910 grains per gallon.

No. 2 bore now produces per annum potash to the value of £1,589, and £712 worth of lime, both of which are water-soluble fertilisers, and in an ideal condition to be made use of by plants. These fertilisers are on the spot, do not cost anything, and are only waiting to be properly utilised. At present about 1,000,000 gallons per diem of this fertilising stream are running to waste in the creek at Coonamble.

The quantity of carbonate of soda in the water from the Weetaliba Bore has been reduced from 50·866 grains per gallon to 8·276 grains per gallon since the bore has been deepened, the quantities of potash and lime both being considerably increased. This bore is not perforated above the 1,488 feet level.

The analyses of the water from the bores on Quambone, Wingadee, Nardoo, and Beanbah, all of which have been deepened, show a considerable reduction in the amount of carbonate of soda with a corresponding increase in the amount of lime and potash, although in some cases some of the flows from the higher levels have been admitted.

ANALYSES of Artesian Waters, by Mr. J. C. H. Mingaye.

Grains per Imperial gallon.

Name of Bore.	Sodium Carbonate.	Potassium Carbonate.	Calcium Carbonate.	Magnesium Carbonate.	Sodium Chloride.	Sodium Sulphate.	Iron Oxide and Alumina.	Silica.	Total solid matter, grains per gallon.
Coonamble, No. 1 ...	40·000	...	1·120	trace.	6·910	...	...	...	48·030
,, No. 2 ...	7·189	3·739	11·742	2·754	2·305	1·365	0·168	1·400	30·662
Weetaliba	50·866	1·393	0·949	0·466	2·956	1·721	0·112	1·876	60·339
,, (deepened)	8 276	4·210	4·846	3·030	3·583	1·603	0·084	1·232	26·432
Wingadee, No. 4 .	47·411	trace.	0·750	0·294	7·464	0·224	trace.	1·624	57·767
,, (deepened)	20·108	3·118	7·400	3·114	4·181	3·037	trace.	1·568	42·526
Nardoo	17·140	2·368	6·545	1·693	3·823	1·603	0·140	1·400	33·964

Brown Lucerne Hay.

This is made either accidentally or by design. Sometimes, when it is intended that dry green hay should be made, it is stacked whilst containing slightly too much moisture, and the changes in the stack result in a brown hay being formed. This is claimed by some to have certain advantages over dry green hay. It is more succulent, freer from dust, and stock, in some cases, show a decided preference for it. Generally speaking, the price obtained is slightly lower than that for prime green hay, but when the sample is good the difference is not very marked. Probably brown hay would be more largely made, especially for dairy cows, were it not for the greater risk of loss by firing. The methods of cutting and curing are the same as in making green hay, except that the hay is not allowed to become so dry in the field. Brown hay is caused by certain fermentative and other changes which take place in the stack, and one of the essentials to these is moisture. They can only occur to a limited extent in hay which has been well dried in the field, and consequently no marked change in the colour occurs. The chief difficulty in making brown hay is to have the right amount of moisture in the hay when stacking. If too much is present the fermentation becomes too active, and the hay is charred, or even spontaneous combustion may occur through the heat generated. It is only by actual experience that the proper time to stack can be learnt, and even men who have handled considerable quantities are liable to make mistakes. In general terms, it may be stated that lucerne which is to be made into brown hay should be stacked about one day earlier than it would be for green hay. The stems should be tough and contain a fair amount of moisture, but when they are tightly twisted the moisture should not exude. Prime green hay should not be stacked until it has a rather crisp feel; but brown hay is made by stacking when a slight dampness can be felt. Brown hay is frequently made where the weather conditions and the nature of the crop render it difficult to successfully make green hay. The lucerne can be carted off the field much sooner after cutting, and when the weather is uncertain. This is an important consideration, as heavy rain falling on cut lucerne does a good deal of damage. The early cut of the season is usually very sappy, and the weather at the time of cutting is not always suitable for drying, and a better quality of feed can often be secured by making it into brown hay.—A. H. E. McDonald.

The Soils of the South Coast.

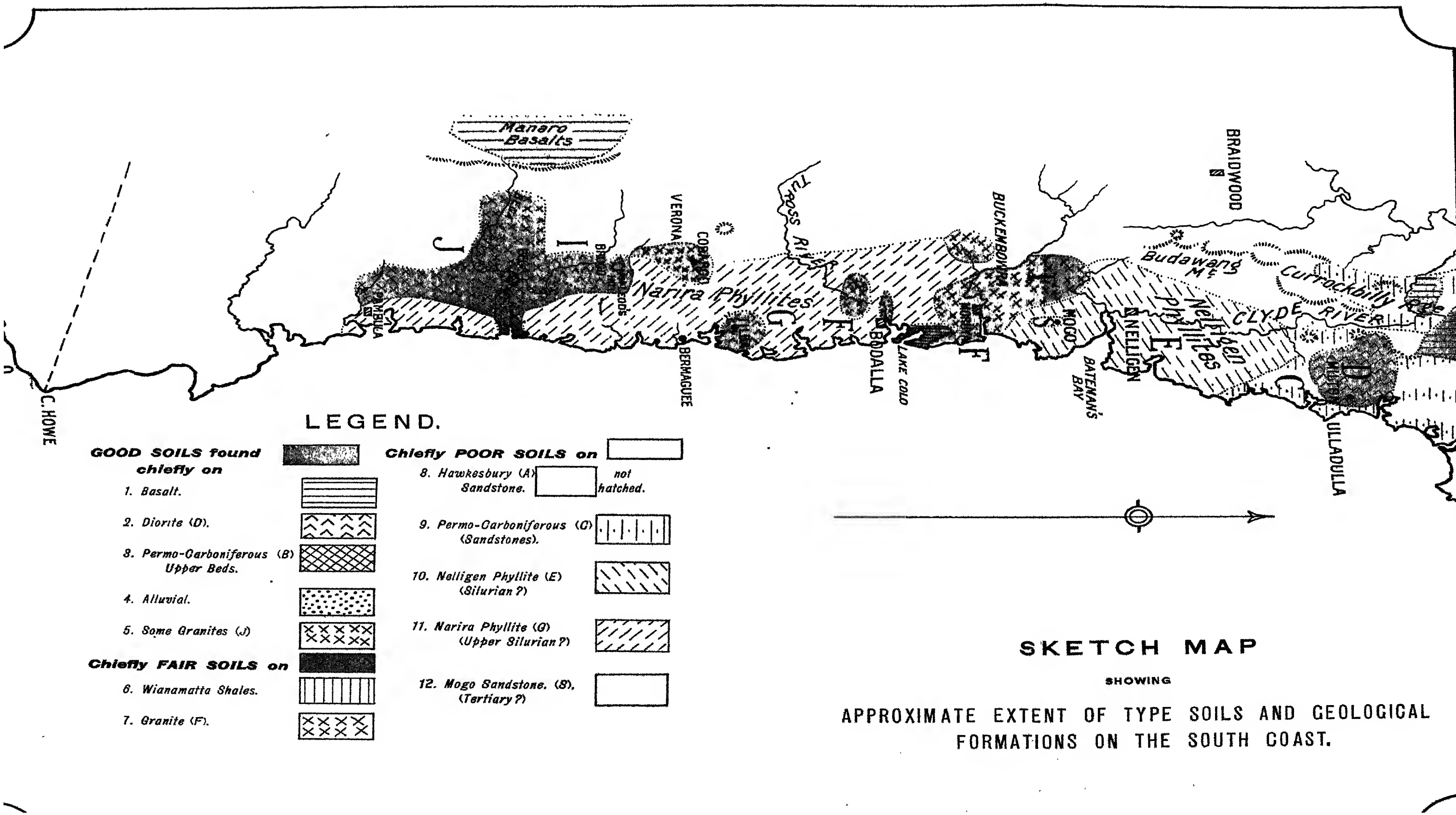
Owing to the accidental misplacement of the two index letters F and J, in the rough draft of the soil map which was published in the February *Gazette*, the colouring of the good and fair granite soil areas was reversed. The Moruya and Bodalla areas, which possess only fair soils, were coloured as good, whereas the Bega and Buckembowra soils, which are good, appeared only as fair. Hence an altogether erroneous impression is conveyed by the map as far as the granite areas are concerned. As all the granitic soils are in the southern half of the map, we reproduce that portion properly corrected.

Government Stud Bulls available for service at State Farms, or for lease.

Breed	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Meerschaum Vale.	8 June, '10.
" ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
" ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Wollongbar Farm.	†
" ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
" ..	Sir Jack ..	Omelette's Pride	Lady Tidy 3rd (imp.).	Berry Farm ...	*
" ..	Berry Melbourne	Melbourne ...	Rum Omelette	Berry Stud Farm .	†
Guernsey ..	Gentle Prince ...	Rose Prince ...	Gentle ...	Wollongbar Farm.	†
" ...	Prince Edward..	Rose Prince ...	Vivid ...	Casino	24 May, '10.
" ...	Star Prince ...	Calm Prince ...	Vivid ...	Dunoon	3 July, '10.
" ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	Wollongbar Farm.	*
"	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Alstonville ...	20 Aug., '10.
" ...	Claudius ...	Golden Star II..	Claudia's Pride.	H.A.College, Richmond	*
Red Poll ...	The Judge ...	Barrister ...	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
" ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
" ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
" ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
" ...	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
" ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A.College, Richmond	*
" ...	Dado	Daniel	Dot	H.A.College, Richmond	*
" ...	Dan of the Roses	Daniel of Auchenbrain.	Ripple Rose...	" "	*
Kerry	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ...	Glen Innes Farm...	†
"	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.



SKETCH MAP

SHOWING

APPROXIMATE EXTENT OF TYPE SOILS AND GEOLOGICAL FORMATIONS ON THE SOUTH COAST.

Department of Agriculture,
Sydney, 2nd March, 1910.

BULLS FOR SALE

ROYAL AGRICULTURAL SHOW.

GUERNSEYS.—Lord Clatford: sired in England by Lord Clatford II, 1814; dam, Clatford Richesse, 6816 (imp.); calved 16th October, 1907; colour, lemon and white; price, £50. **Clatford Richesse is a fine type of dairy cow.**

Simple Simon: sired in England by Suzeram III; dam, Muriel 19th (imp.), 7022; calved 9th May, 1908; colour, lemon and white; price, £50.

King's Jubilee: sired in England by Hayes' Coronation II, 1841; dam, Hayes' Muzette 7th, 6904; calved 25th May, 1908; price, £50.

AYRSHIRE.—Scotland's Hope: sire, Jamie's Ayr; dam, Judica, **from Juliette, by Prince Emerald (imp.)**; calved 21st February, 1908; colour, brown and white; price, £15.

JERSEYS.—Jack's Joy: sire, Sir Jack; dam, Rum Omelette II, **from Rum Omelette (imp.), by Golden Lord**; calved 4th June, 1908; colour, whole; price, £30.

Dreadnought: sire, Sir Jack; dam, Lady Kitchener, **from Egyptian Princess (imp.), by Lord Melbourne**; calved 22nd October, 1908; colour, whole; price, £20.

Calceolaria's Lad: calved 6th July, 1907; sire, Melbourne (imp.); dam, Calceolaria (imp.); colour, whole; price, £30.

Berry Melbourne: sire, Melbourne (imp.); dam, Rum Omelette (imp.); calved 23rd August, 1906; colour, whole; price, £50.

HOLSTEINS.—Maastricht: sire, Obbe II; dam, Lady Margaret; calved 26th June, 1908; price, £15.

Count Wittereen: sire, Obbe II; dam, Lolkje Zuyder Zee; calved 27th November, 1908; price, £15.

HAWKESBURY AGRICULTURAL COLLEGE.

GUERNSEYS.—Duke of Richmond: sire, Prince Milford; dam, Alexandrina 9th, 6399 (imp.); calved 6th June, 1909; colour, lemon, fawn, and white; price, £40.

Prince Milford, sire of Duke of Richmond, is by Rose Prince (imp.), from Flaxy (imp.). Alexandrina 9th, dam of Duke of Richmond, is by Pomegranate (1510), from Alexandrina 2nd (3220), by Benefactor (659), from Alexandrina (3219).

Dante: sire, Prince Milford; dam, Angelica 8th (imp.), 5630; calved 14th July, 1909; colour, fawn and white; price, £40.

Angelica 8th, dam of Dante, is by Captain Powell (1430), from Angelica (749).

WOLLONGBAR EXPERIMENT FARM.

GUERNSEY.—Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909; price, £45.

HOLSTEIN.—Dutchman II: sire, Hollander; dam, President's Schot; calved 30th December, 1908; price, £10.

Applications for the bulls at Wollongbar Experiment Farm will be held till 21st March. If more than one application be received for any one bull, his disposal will be decided by ballot.

The prices indicated are at the places named, or on rail.

H. C. L. ANDERSON,
Under Secretary.

Orchard Notes.

W. J. ALLEN.

MARCH.

THANKS to the heavy rains which fell at intervals during the month of January, the numerous orchards throughout the State never looked better. Unlike a year ago, both old and young citrus trees have put on a wealth of growth, and the trees look the picture of health.

Growers are still busy marketing their fruit, which, with the cultivation of the orchards and picking up and destroying diseased fruit, in accordance with the regulations under the Fruit Pests Act, keeps them going from early morning until late at night; but this is only what we anticipate, as harvesting time is always a busy season, be the crops what they may.

Cultivation.

Wherever the weeds have been allowed to go unchecked since the late rains, they should be turned under some time this month; and if crops for green manures, such as grey field peas, tares, rape, or rye, are to be sown among the trees they should be put in as early as possible. If, however, no crop is to be sown, it would be well to allow the land to remain in the rough state after ploughing. It will gradually mellow down and remain in good condition until it is time to plough it again next spring.

Grading and Packing Fruit.

If growers would be more careful about this important work, they would (in my opinion) usually have less cause for complaint as to the prices obtained for the fruit by their agents. In the first place it is essential to see that the trees are well looked after, so that the fruit produced will be at least average specimens of their kind. Some growers, though, are not satisfied to grow only average specimens, but produce fruit above the average, by doing the work thoroughly; after which the grading and packing are easy of accomplishment. Their brands soon become known, and in consequence they seldom have cause to complain of the prices they obtain for their fruit. Fruit-growers in this State find in Sydney and some of the larger towns, a market second to none in Australia.

Preparing Land for Planting this coming Winter.

The land has never been in better condition for clearing, grubbing, ploughing, and subsoiling, preparatory to planting, than it is now, and those who intend planting this coming winter, and who have not completed these operations, should lose no time in finishing this work, so that new land will have a little time to sweeten before the young trees are set, as well as to enable the orchardist to complete all planting operations early in the winter.

Fruit Fly and Codlin Moth.

It seems almost incredible that any fruit-grower who is alive to his own interests would allow fly or moth infested fruit to lie on the ground until the grubs have left them, but such is the case, and it is to these careless growers that we are usually indebted for the breeding and spreading of many of our pests. It is also these growers who give so much extra trouble to our Inspectors under the Fruit Pests Act, in seeing that no neglect takes place. It may be well for such careless growers to remember that they are a menace to their neighbours, and that by neglecting to pick up and destroy all fallen and infested fruit they are liable to a fine. Any fruit-grower would be quite justified in notifying the Department whenever he is sure that his neighbours are trying to shirk their responsibility in this matter.

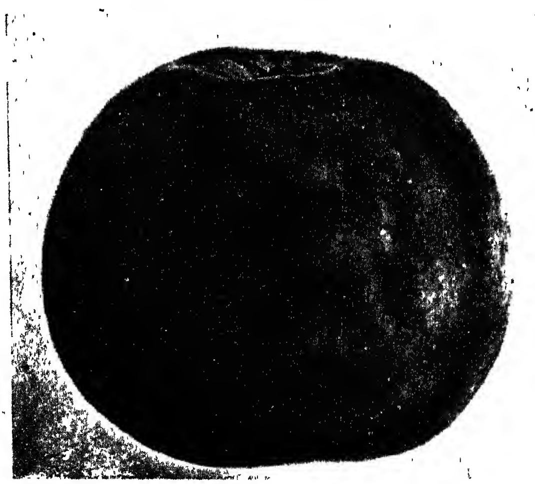
Budding.

It is rather late, but if the month should prove a warm one, it is quite possible that buds would still take if inserted in deciduous trees which are not producing either good fruits or satisfactory crops.

Nursery stock may still be budded.

"Zouch's Pippin" Apple.

This variety does very well in the vicinity of Sydney. In colour it is greenish yellow, is of medium size, and rather good flavour, and owing to its being one of the earliest is worth a place in any collection. I am indebted to Mr. H. Selkirk for the following description:—"This apple was one of five seedlings raised at Balmain by the late C. J. Zouch, an officer of the Lands Department, from pips taken from an imported American apple. After testing, the raiser discarded four of the trees as worthless, but made the remaining one over to the late Hon. P. L. C. Shepherd, who placed it on the market in 1890 under the name of 'Zouch's Pippin.'



"Zouch's Pippin" Apple. Natural size.

"It has proved to be a remarkably early variety, ripening before Christmas in the vicinity of Sydney, and should on account of its earliness and quality be specially valuable for home consumption both as a dessert and cooking apple. The tree is of upright growth, of robust constitution, comes early into bearing, and is a prolific and reliable bearer."

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Albion Park A., H., and I. Association	Hector G. Fraser..	Mar. 1, 2
Tamworth A. Association	J. R. Wood ...	,, 1, 2, 3
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskins ...	,, 1 to 5
Yass P. and A. Association	Will Thompson ...	,, 2, 3
Braidwood P., A., and H. Association	L. Chapman ...	,, 2, 3
Coraki A. and H. Society	D. Cameron ...	,, 2, 3
Bega A., P., and H. Society	W. A. Zuegel ...	,, 2, 3, 4
Nepean District (Penrith) A., H., and I. Society ...	Percy J. Smith ...	,, 3, 4
Berrima District A., H., and I. Society	....	,, 3, 4, 5
Molong Agricultural Society	A. D. Millar ...	,, 8
Bombala Exhibition Society	W. G. Tweedie ..	,, 8, 9
Murrumburrah P., A., and I. Association	J. A. Foley ...	,, 8, 9
Bangalow A. and I. Society	W. H. Reading ...	,, 8, 9, 10
Central New England P. and A. Association (Glen Innes), National Show.	Geo. A. Priest ...	,, 8 to 11
Tumbarumba and Upper Murray P. and A. Society...	E. W. Figures ...	,, 9, 10
Quirindi District P., A., and H. Association... ...	W. Hungerford ...	,, 9, 10
Campbelltown A. Association	Fred. Sheather ...	,, 9, 10
Berry Agricultural Association	C. W. Osborne ...	,, 9, 10, 11
Mudgee Agricultural Society	H. Lamerton ...	,, 9, 10, 11
Warialda P. and A. Association	A. J. Devine ...	,, 9, 10, 11
Crookwell A., P., and H. Association...	M. P. Levy ...	,, 10, 11
Port Macquarie and Hastings District A. and H. Soc.	W. R. Stacy ...	,, 10, 11
Oberon A. and P. Society	W. Minehan ...	,, 10, 11
Newcastle A., H., and I. Association	C. W. Donnelly ...	,, 10, 11, 12
Cobargo A., P., and H. Society	T. Kennelly ...	,, 11, 12
Dapto A. and H. Society	G. A. McPhail ..	,, 15, 16
Blayney A. and P. Association	E. J. Dann ...	,, 15, 16
Cooma P. and A. Association	C. J. Walmsley ...	,, 15, 16
Kyogle P., A., and H. Society	P. C. Beer ...	,, 15, 16
Inverell P. and A. Association	J. McIlveen ...	,, 15, 16, 17
Armidale and New England P., A., and H. Association (Armidale).	A. McArthur ...	,, 15, 16, 17, 18
Cumnock P., A., and H. Association	A. M. Martin ...	,, 16
Gloucester A. Society	E. Rye	,, 16, 17
Coonabarabran P. and A. Association...	Geo. B. McEwen	,, 16, 17
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 16, 17, 18
Camden A., H., and I. Society...	C. A. Thompson...	,, 16, 17, 18

Society.	Secretary.	Date.
Goulburn A., P., and H. Society	J. J. Roberts ...	Mar. 17, 18, 19
Royal Agricultural Society, Royal Agricultural Show	H. M. Somer ...	,, 22 to 30
Southern New England P. and A. Association (Uralla)	W. C. McCrossin..	,, 22, 23
Taralga A., P., and H. Association	C. Ross ...	,, 31, April 1
Nambucca A. and H. Association	R. Turnbull ...	,, 31, April 1, 2
Gundagai P. and A. Society	A. Elworthy ...	April 5, 6
Walcha P. and A. Association	J. New Campbell..	,, 5, 6
Adaminaby P. and A. Association	W. Delaney ..	,, 6, 7
Bathurst A., H., and P. Association	A. H. Newsham ..	,, 6, 7, 8
Bowra A. Association	C. Moseley ...	,, 7, 8
Orange A. and P. Association	W. Tanner ...	,, 13, 14, 15
Richmond River A., H., and P. Society (Casino) ...	W. S. Rayner ...	,, 14, 15
Upper Manning A. and H. Association (Wingham)...	D. Stewart, jun....	,, 14, 15
Luddenham A. and H. Society	W. Booth ...	,, 14, 15
Moree P. and A. Society...	D. E. Kirkby ...	,, 19, 20, 21
Narrabri P., A., and H. Association	W. Malane ...	,, 19, 20, 21
Hunter River A. and H. Association (West Maitland)	C. J. H. King ...	,, 19, 20, 21
Wellington P., A., and H. Society	A. E. Rotton ...	,, 20, 21
Clarence P. and A. Society	T. T. Bawden ...	,, 20, 21, 22
Macleay A., H., and I. Association (Kempsey) ...	E. Weeks	,, 20, 21, 22
Lower Clarence A. Society (Maclean)	F. W. Collison ...	,, 26, 27
Dubbo P., A., and H. Association	F. Weston ...	,, 27, 28
Durham A. and H. Association...	Chas. E. Grant ...	,, 27, 28
Cobar P. and A. Association	D. H. Dunlop ...	May 4, 5
Hawkesbury District A. Association (Windsor) ...	H. S. Johnston ...	,, 5, 6, 7
Merriwa A. and P. Association...	V. Budden ...	,, 17, 18
Nyngan and District P. and A. Association	R. H. A. Lyne ...	,, 18, 19
Walgett P. and A. Association...	S. E. Johnston ...	,, 18, 19
Deniliquin P. and A. Society	L. Harrison ...	July 21, 22
Hay P. and A. Association	G. S. Camden ...	,, 26, 27
Riverina P. and A. Society (Jerilderie)	W. Elliott ...	,, 26, 27
Narrandera P. and A. Association	W. T. Lynch ...	Aug. 3, 4
Corowa P., A., and H. Society...	J. D. Fraser ...	,, 16, 17
Murrumbidgee P. and A. Association	A. F. D. White ...	,, 23, 24, 25
Parkes P., A., and H. Association	G. W. Seaborn ...	,, 24, 25
Junee P., A., and I. Association	T. C. Humphrys...	,, 31, Sept. 1
Young P. and A. Association	G. S. Whiteman...	Sept. 6, 7, 8
Ariah Park P., A., H., and I. Association	A. T. White ...	,, 7
Germanton P., A., and H. Society	J. S. Stewart ...	,, 7, 8
Albury and Border P., A., and H. Society	W. I. Johnson ..	,, 13, 14, 15
Ganmain A. and P. Association	J. H. Ashwood ...	,, 14
Temora P., A., H., and I. Association...	John Clark ...	,, 20, 21, 22

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VOL. XXI. PART 4. APRIL 2, 1910.

Agricultural Gazette of New South Wales.

Mudgee—Dunedoo District.

H. C. L. ANDERSON.

THE extension of the railway line from Gulgong to Dunedoo, which, it is expected, will be ready for traffic this year, is going to open up a large tract of valuable agricultural country and considerably increase our wheat-growing area.

Between the main Western line and Mudgee, the branch railway runs through more or less mountainous country (descending from 3,050 feet near Wallerawang to 1,586 feet at Mudgee) which does not contain any great areas of agricultural land. Around Mudgee itself there are some thousands of acres of excellent alluvial flats (formed by the Cudgegong River and its tributaries) which have made a great reputation for Mudgee lucerne, and have naturally caused this area to develop into a good dairying district. The amount of arable wheat land, however, is circumscribed by the natural conditions of the district. But as the country opens out beyond Gulgong into rolling downs, gently sloping hills, and flats formed by the rivers and creeks fed by the surrounding hills, there is found a large area of agricultural land of high quality. There is a fall of 110 feet between Mudgee and Gulgong, after which there is a slight rise of 80 feet again towards Dunedoo. It may be estimated that within 20 miles of both sides of this railway there will be found 200,000 acres of good wheat land, which, under a proper system of mixed farming, will give profitable occupation to 1,000 farmers and labourers, and indirectly supply work for three times as many people in the towns and villages of the State.

The geological formation of this district is of a very varied character, the soil-producing rocks comprising basalts and granites; sandstones and shales belonging in the main to the Hawkesbury Series and the Upper Coal Measures; and Silurian slates. One can find outcrops of limestone, basalt, conglomerate, slate, sandstone, beside the original granite, and large areas of alluvial formation. The district has long been famous for its mineral wealth, and has already produced large quantities of gold, silver, and lead, and many believe that there is still a great future before the mining industry, although it is somewhat quiescent at present. However that may be, the agricultural possibilities are undoubted, and the different qualities of soil are as distinct as the wonderful varieties of geological formation.

The analysis, by Mr. Guthrie's staff, of seven typical soils, each representing large areas of arable land suitable for mixed cultivation, is printed herewith, and a few notes offered on the special characteristics of each soil.

By the courtesy of Mr. E. J. Lowe, of Birriwa Station, close to the new line and about 25 miles from Gulgong, we are also enabled to give details of the rainfall for the past 25 years. The monthly averages will be very useful

to intending settlers, especially when compared with similar figures for other centres of the district, supplied by the Meteorological Bureau.

The climatic conditions entirely support the claims of the district for its wheat-growing capacity. Plenty of rain falls during the growing period, and it is specially interesting to note that no month is strikingly deficient, January being the wettest with an average of 259 points, and July the driest with 175.

The maximum temperature recorded at Mudgee was 114·4°, and the minimum 15·2° Fahr.

Soil samples Nos. 1, 4, and 6 may be called typical wheat soils, which will yield good crops for many years to come, provided they get fair and rational treatment. On the soil of which the No. 1 is typical, crops varying from 21 to 30 bushels per acre were obtained during last season. This soil is a particularly satisfactory one, both in mechanical and in chemical condition, and represents many thousands of acres of the reddish-brown ridges that are to be found between Gulgong and Dunedoo and many other districts within a 20-mile radius. The type may be seen in Mr. Lowe's wheat paddocks at Birriwa.

No. 4 is a much lighter soil, containing less clay and a considerable quantity of fine gravel. It has lower capacity for holding moisture, but a good subsoil and excellent capillary power. Its percentage of potash is much lower than that of No. 1, but still fairly satisfactory for wheat. Its worst deficiency is in organic matter, and consequently nitrogen, and it would therefore be highly desirable to sow lucerne on such a soil, and graze it for a few years, in rotation with wheat. Every opportunity should be taken of adding to the vegetable matter in the soil, and it should not be depleted by a continuous succession of cereal crops, both grain and straw being removed. It will probably be found advantageous to give light dressings of potash at an early date, but the lucerne and any other leguminous crop found suitable to the district will bring up supplies from the subsoil for the use of any cereal plant that is grown in rotation with it. There are several good native leguminous plants—trefoils and vetches—that will help to renovate the soil while lying under natural pasture. This type of soil may be seen in the Birriwa reserve.

No. 6 is a very satisfactory wheat soil from every point of view. It is somewhat deficient in nitrogen, but this can be easily rectified by using 2 or 3 lb. of lucerne seed with every cereal crop, allowing the lucerne to develop after the cereal has been taken off, then feeding it to sheep or other stock. The lucerne will capture a considerable quantity of nitrogen from the air, and the greater part of this will be returned to the soil in the dung of the grazing stock, while the roots will enrich the soil when turned over by the plough. This type of soil may be found on the strong red loamy hills along the Talbragar.

Nos. 3, 5, and 7 are somewhat similar, inasmuch as they are all the result of sedimentary washings from hills more or less distant—some from basaltic outcrops miles away, and others from the ridges in the immediate vicinity.

No. 3 is not too heavy a soil, containing less clay than the other two similar ones, does not crack, and is richly supplied in all the essentials for high fertility. It is principally found along the smaller creeks and depressions between undulating hills. It is, if anything, too rich for wheat, which

Analysis of Soils from Mudgee–Dunedoo District.

No. of Sample and Description.	Nature of Soil.	Nature of Subsoil.	Colour of Soil.	Reaction of Soil.	Capacity for Water.	Absolute Weight per acre, 6 inches deep.	Capillary power.	Mechanical Analysis. — Coarse Gravel, more than 1-10th inch diameter.	Mechanical Analysis. — Fine Gravel, more than 1-50th inch diameter	Mechanical Analysis. — Fine Soil. — Sand.	Mechanical Analysis. — Fine Soil. — Impalpable Matter, chiefly Clay	Analysis of Fine Soil. — Moisture.	Analysis of Fine Soil. — Volatile and Combustible Matter, principally Organic.	Percentages of Fertilising Substances—General Value. — Nitrogen.	Percentages of Fertilising Substances—General Value. — Lime (CaO).	Percentages of Fertilising Substances—General Value. — Potash (K_2O)	Percentages of Fertilising Substances—General Value. — Phosphoric Acid (P_2O_5).
					Per cent.	lb.	Inches	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
No. 1.—Wheat land of district, of good average quality.	Loam..	Rock met at 180 ft.	Light brown.	Slightly acid.	41 (fair).	1,629,252	7¾ (very good).	4·0	9·3	45·0	41·7	2·93	5 82	·168 (good).	·364 (good).	·201 (good).	·183 (satisfactory).
No. 2.—Light soil, typical of a considerable area of district.	Light sandy loam.	....	....	do	21 (very low).	2,104,450	4 (fair).	8·3	41·7	33 3	16 7	·42	2·12	·084 (fair).	203 (good).	·110 (satisfactory).	·068 (fair).
No. 3.—Rich black alluvial soil, typical of flats along watercourses.	Loam..	....	Black..	do	43 (fair).	1,459,538	10 (excellent)	1·6	13·2	33·3	51·8	6 075	7·395	·154 (good).	·508 (very good).	·258 (good)	·217 (good).
No 4.—Wheat land of very fair average quality.	Light sandy loam, 15 in. deep.	Yellow clay.	Red brown.	Acid ..	30 (low).	1,900,794	Over 10 (excellent)	10·3	29·0	43·3	16·8	2·41	8·95	·07 (fair).	·236 (good).	071 (fair).	·157 (satisfactory).
No. 5.—Black alluvial along Talbragar and other rivers and creeks.	Heavy loam.	....	Black.	Slightly acid.	47 (good).	1,731,080	8 (very good).	Nil.	7·3	25·0	67·7	6·28	8·54	·231 (good).	·562 (very good).	·32 (good).	·205 (good).
No. 6.—Typical of large area of good wheat land.	Loam, 12 in. deep.	Red clay.	Light brown.	Acid ..	30 (low).	1,798,965	8¼ (very good).	1·16	22·0	41·6	35 08	6·52	8·29	·077 (fair).	·182 (satisfactory)	169 (satisfactory).	·137 (satisfactory).
No. 7.—Good loamy soil from depressions, washings from hills.	Heavy loom.	....	Dark brown.	Slightly acid.	44 (fair).	1,459,538	Over 10 (excellent)	0·66	4·66	28 3	66·38	4·0	7·0	·126 (satisfactory).	·58 (very good).	·172 (satisfactory).	·126 (satisfactory)

would probably grow very strong and make too much flag, necessitating being eaten down with sheep. It will grow excellent lucerne, also maize, cowpeas, and green fodder of all kinds, and a proportion of it would be of great value on a dairy farm. Such soil should need no manuring for years to come, if care be taken not to deplete the organic matter, and leguminous and other renovating crops be sown in the rotation.

No. 5 is a very heavy alluvial soil, formed on the banks of the Talbragar River by deposits from basaltic ridges and other igneous rocks near the sources of that river. It has an exceedingly tenacious subsoil, containing nearly 68 per cent. of clay, and opens in large cracks in dry weather. It is very well supplied with plant food, has good capacity for holding moisture, and very good capillary power, but would be difficult to work; the top soil would need thorough cultivation in order to supply a fine mulch to minimise the cracking which is so injurious to the crops in summer time. Probably lucerne would give most satisfaction for some years, until the soil had been worked down into a more kindly condition. A crop like cowpeas, that would cover and shade the ground, would be suitable. Above all, never work it nor put stock on it when wet.

No. 7 represents a considerable number of pockets of soil of smaller or larger area, consisting of the washings from hills which have filled up depressions and gullies. It is a good soil of great strength, two-thirds being clay, stiff to work, but capable of improvement by constant treatment at the right time. This soil is typical of the Cudgegong flats of the Mudgee district, and of those along many of the smaller creeks amongst the mountain ranges. It will grow excellent crops of maize, lucerne, and all kinds of fodder plants and vegetables, but is too strong for wheat.

The poorest soil is No. 2, which is light in colour and sandy in character, containing a considerable amount of fine gravel and rather a small percentage of clay. It is weak in phosphoric acid and in nitrogen, satisfactory in lime and potash, and excellent in its mechanical condition. It has a very low capacity for retaining moisture, and poor capillary power. It represents large areas of light-coloured soils of light texture, such as those on the Mudgee racecourse, in the police paddock, and on many of the lower slopes in the district. It is admirably adapted for the cultivation of fruit and vines, and would do fairly well with wheat in a good season, but would be likely to suffer quickly from dry weather, and would soon show the results of its deficiency in phosphoric acid. It would repay small dressings of superphosphate from the very start, and every opportunity should be taken of enriching the soil with vegetable matter, by growing such crops as rape, cowpeas, lucerne, sheep's burnet, yarrow, and other fodders, on which sheep and other stock could be grazed. The constant aim should be to increase the humus, catch nitrogen from the air, and supplement the phosphoric acid by small dressings of bone-dust or superphosphate with each crop. None of the soils will demonstrate the value of scientific treatment more than this one, and it is safe to predict that any man who will work it on the best principles dictated by past experience in this State will get results from it as

good as those from the richer lands farmed by men with less knowledge. In going through this Mudgee-Dunedoo district, one cannot fail to notice how many selections of all sizes, from 40 to 640 acres, have been made into freeholds and then abandoned as homes and living areas, being absorbed into the adjacent or surrounding pastoral areas. The significance of this cannot be ignored; but it has been, unhappily, universal in many other districts now being successfully used for closer settlement. In spite of this, I feel confident that within ten years there will be great development in comfortably settling many farmers on areas of 200 to 600 acres in this district, thereby adding thousands to its next census returns, improving the social conditions of life, and increasing the productive value of the whole district five-fold. Improved means of communication and the advance of agricultural knowledge are going to help in developing it to its proper position among the farming districts of New South Wales.

Mudgee-Dunedoo District.

RECORD of the Rainfall at Birriwa from January, 1885, to December, 1909, in points (100 points = 1 inch).

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1885 .	233	143	131	182	87	316	35	24	232	65	102	182	1,732
1886 ..	132	61	43	423	265	189	395	551	40	297	478	347	3,221
1887 .	612	471	348	112	128	202	221	645	83	266	474	764	4,326
1888 .	56	369	34	..	146	67	49	7	208	78	60	41	1,115
1889 .	137	140	198	388	477	311	106	209	77	357	273	312	2,985
1890 .	219	969	468	259	349	270	299	99	365	97	123	243	3,760
1891 ..	850	126	326	147	247	413	267	276	476	101	182	109	3,520
1892 ..	229	80	138	472	212	197	361	104	655	388	244	258	3,338
1893 ..	145	208	667	271	296	192	237	287	176	341	378	84	3,282
1894 ..	591	154	969	263	117	184	286	110	170	376	93	294	3,607
1895 ..	776	114	..	9	118	107	155	170	259	248	272	309	2,537
1896 ..	157	483	178	197	335	165	146	167	46	142	68	418	2,502
1897 .	429	123	75	..	440	223	284	87	160	136	32	177	2,166
1898 .	453	402	..	.	237	602	47	389	150	358	27	93	2,758
1899 ..	169	17	22	286	10	185	130	234	108	52	150	60	1,423
1900 ..	243	42	344	176	253	232	226	47	116	30	67	92	1,868
1901 ..	139	27	431	271	140	127	63	324	28	147	85	..	1,782
1902 ..	130	71	84	..	..	68	66	301	81	123	198	211	1,233
1903 ..	10	27	178	359	170	24	158	141	468	189	274	294	2,392
1904 ..	130	509	292	154	126	69	356	138	41	312	35	162	2,324
1905 ..	28	196	221	332	255	85	130	129	14	127	86	9	1,612
1906 .	10	116	247	84	84	181	54	300	319	186	300	164	2,045
1907 ..	235	42	179	40	21	177	198	178	91	55	423	172	1,811
1908 ..	240	535	161	73	122	130	73	137	194	43	254	109	2,071
1909 .	116	517	59	147	76	384	42	399	113	257	241	481	2,832
Average for 25 years..	259	237	232	186	188	204	175	218	187	191	197	215	2,489

AVERAGE Rainfall during each month of the year in Mudgee-Dunedoo District for a period of from 20 to 40 years, ending 31st December, 1906 (supplied by the Commonwealth Meteorologist).

Station.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Coolah ..	276	262	261	183	211	236	198	244	210	225	217	279	2,802
Gulgong .	252	216	251	225	205	242	177	202	203	225	204	253	2,655
Mudgee ..	223	221	200	210	222	249	184	207	234	236	198	243	2,627

Varieties of Wheat recommended by the Department of Agriculture.

(Continued from page 193.)

GEO. L. SUTTON, Wheat Experimentalist.

Haynes' Blue-stem.*

HAYNES' Blue-stem is a tall variety, stooling fairly freely. The foliage is of good colour. The straw when ripe is white and is rather slender, but very elastic. The ear is slightly tip-bearded, and has white chaff, which is covered with fine velvety hairs. The chaff is very open and grips the grain so loosely that it often protrudes from the glumes. The grain, which is not very large, is reddish, hard, and plump when grown under good conditions.

Haynes' Blue-stem is one of the strong-flour varieties, and is used by millers for blending with the soft kinds. It is one of the varieties selected and distributed by the Minnesota Experiment Station, and is also called by them "Minnesota No. 169." It is considered by that Station to be one of the best varieties for their conditions, and was the parent of a cross-bred, which for some years was considered the most prolific and best all-round variety they had produced. It is also known as "South Dakota No. 1."

It is a late variety, and only suitable for cool moist districts similar to that of Glen Innes. It is resistant to rust, but shells badly. It shells so easily that it is quite unsuitable for harvesting with the stripper, and should always be harvested on the green side.

For hay in cool districts, it is admirably suited. At the Glen Innes Experiment Farm it has so far proved the best for that purpose, consistently yielding heavy crops of fodder of excellent quality.

John Brown.

John Brown is a tall, erect, compact, free-stooling variety. The young growth is fairly vigorous, and of fairly good colour. The foliage is fairly abundant, with leaves inclined to be broad, rather stiff, erect, and of good colour. The straw when ripe is yellowish white, and inclined to be stout. The ears are long, brown, fairly compact, slightly tapering, and very slightly tip-bearded. The chaff is a pale reddish amber, smooth, and grips the grain close enough to prevent shedding. The grain is fairly large, whitish, and, under good conditions, very plump.

* The illustration of this variety is not yet ready, but will be inserted in our May issue.—ED.

Fig. 8.—John Brown.

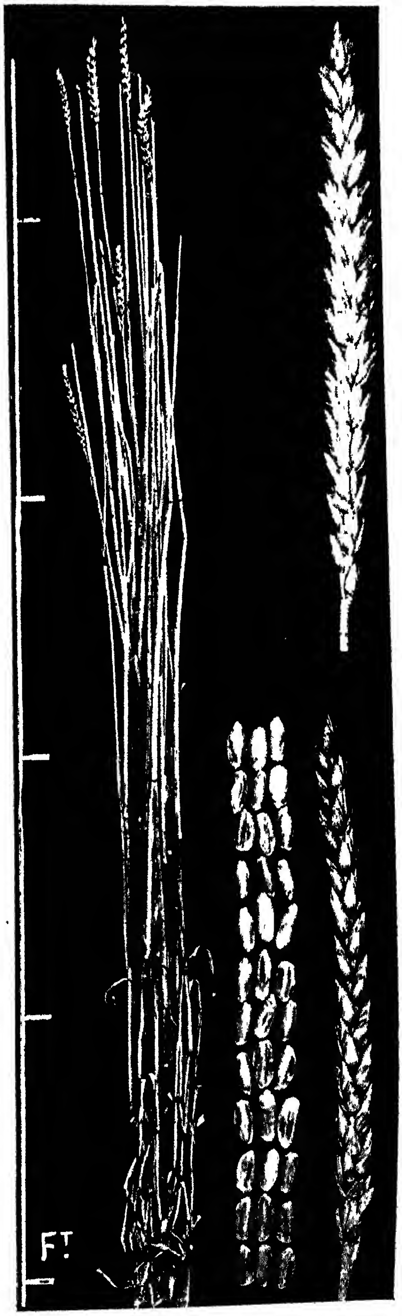


Fig. 9.—Jonathan.

Varieties of wheat recommended by the Department of Agriculture.

Fig. 11.—Marshall's No. 3.

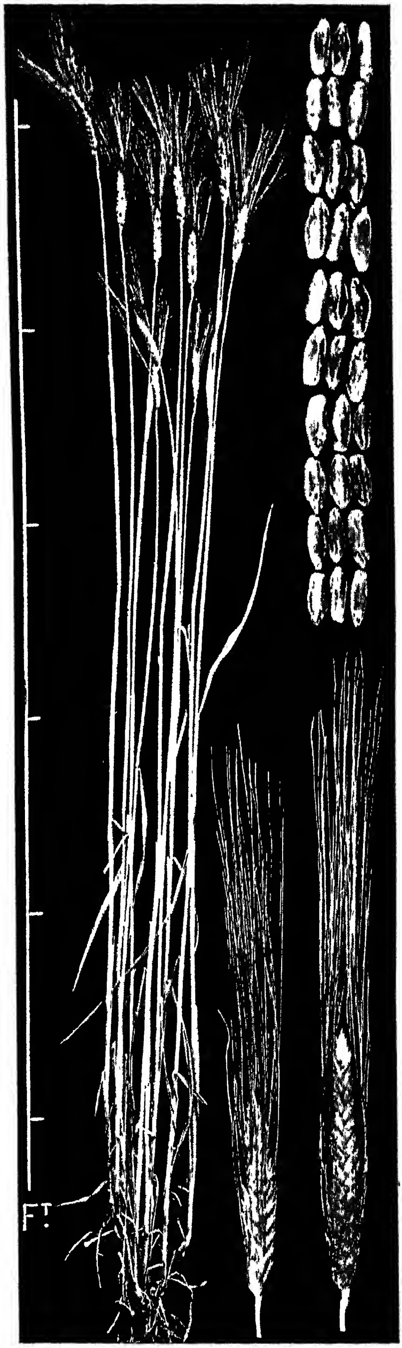


Fig. 12.—Medeah.

Varieties of wheat recommended by the Department of Agriculture.

John Brown is the result of rather a complicated cross, and has the following pedigree :—

Blé carré × Ward's White
Improved Fife × Unnamed
Hornblende × Unnamed
Unnamed × Lambrigg Australian Talavera
John Brown

The cross was made in 1896 and named in 1901.

When maturing, the long, level-headed, brown ears of a well-grown crop are a pleasing sight. It was the regular, brown appearance of such a crop that suggested its name.

At the present time, John Brown is considered a late variety, though, when compared with the season of Dart's Imperial and similar varieties, it is early mid-season. It is a good rust-resister, and, therefore, adapted for cultivation in the coastal areas. It is suitable for early and midseason sowing in the warm grain districts, and for midseason and late sowing in the cool ones. It is subject to frosting, and the precaution of feeding off should be taken to protect it from danger from this source. It is also bunt liable.

It produces good crops of hay and grain. The quality of the hay is slightly lessened by the colour of the head and by the yellowish flag. In dry districts, except in good seasons, the large grain rarely fills, and, in consequence, it has not an attractive appearance.

As a milling variety, it belongs to the "Medium Strong" class; but its cultivation for grain is discouraged because of the dark colour of its flour.

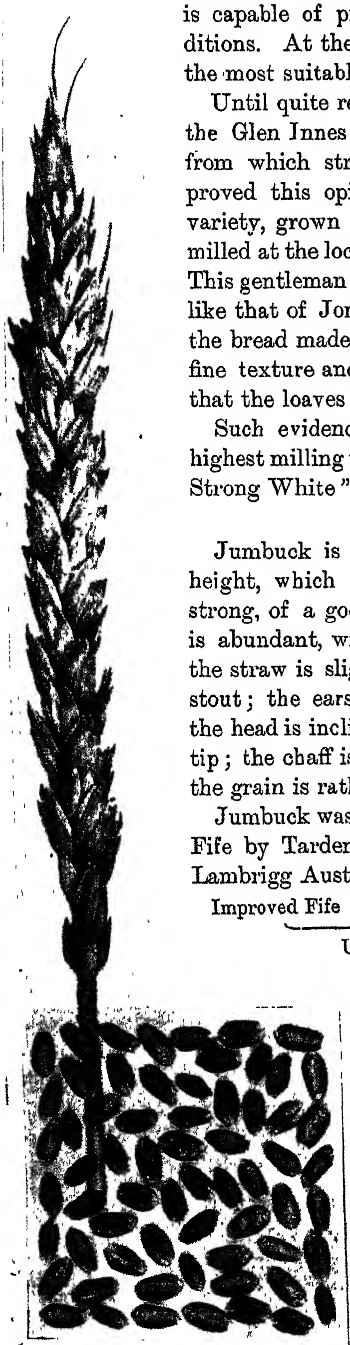
Jonathan.

Jonathan is a fairly erect-growing variety, of medium height. It stools moderately The somewhat scanty foliage is erect, stiff, and of good colour. The straw is white, hollow, rather slender, but fairly strong and supple. The ears are bald, of medium length, and slightly tapering. The spikelets are not very open; the chaff is sharp-pointed, and adheres closely to the grain. The grain is small, bright, hard and flinty.

It is a crossbred, produced as the result of combining Fife varieties with Indian varieties. Its complete pedigree is as follows :—

Hornblende × Indian G
Improved Fife × Unnamed
Unnamed × Indian G
Jonathan.

Jonathan is a midseason variety, preferring cool moist districts rather than warm ones. In dry districts it is an indifferent yielder except in good seasons, and then its slender straw is apt to be weak. It holds its grain so tightly that it is unsuitable for stripping; but it can be left in the paddocks for weeks without danger of shedding. The colour of its foliage renders it



a suitable variety for hay. It is highly rust-resistant, and is capable of producing a strong grain under adverse conditions. At the Glen Innes Experiment Farm it has proved the most suitable all round variety yet tried.

Until quite recently, the opinion held by millers was that the Glen Innes district was incapable of producing wheats from which strong flour could be made. Jonathan has proved this opinion to be unsound. Some grain of this variety, grown at the Glen Innes Experiment Farm, was milled at the local mill, and the flour tested by a local baker. This gentleman reported that he previously had had no flour like that of Jonathan for improving other flour, and that the bread made from it was well risen, of good flavour, with fine texture and crumb, and a good crust. He also stated that the loaves made from it were fit for any exhibition.

Such evidence as this stamps its grain as being of the highest milling value. It belongs to the "New South Wales Strong White" class.

Jumbuck.

Jumbuck is rather an erect-growing variety, of medium height, which stools moderately. The young growth is strong, of a good dark colour, and semi-erect; the foliage is abundant, with leaves that are long, broad, and limp; the straw is slightly purple, of medium height, and fairly stout; the ears are well tipped, and slightly tip-bearded; the head is inclined to be open, and to slightly taper at the tip; the chaff is yellowish-white, woolly, and not very close; the grain is rather dark, of good size, and plump.

Jumbuck was produced as the result of crossing Improved Fife by Tardent's Blue, and then mating the progeny with Lambrigg Australian Talavera. Its pedigree is:—

Improved Fife × Tardent's Blue

Unnamed × Lambrigg Australian Talavera

Jumbuck.

It received its name, "Jumbuck" (a country name for a sheep) because of the woolly appearance of its chaff.

Jumbuck is rather a late variety, though at one time it would have been considered a mid-season variety. It is suitable for early planting in warm districts, and for mid-season planting in cool ones. It is not suitable for moist districts, as it is very rust liable. It is also smut liable.

Fig. 10.—Jumbuck.

It is a prolific yielder of both hay and grain; the woolly chaff, however, slightly reduces its value as a hay variety.

As a milling variety it is at the head of the "Soft White" class.

Marshall's No. 3.

Marshall's No. 3 is a late mid-season variety, which is usually of medium height, but which occasionally grows tall. It stools freely; the young growth is fairly vigorous, and creeping rather than erect; the foliage is very abundant, of fairly good colour, and with broad, limp leaves; the ripe straw is purple, stiff, hollow, and stout; the yellowish-white ears are of medium size, slightly pointed, and slightly tip-bearded; the spikelets are not set very close together; the chaff is white, smooth, and open; the grain is of fair size, but not very plump, except under good conditions.

This variety is a cross-bred, and was produced by Mr. R. Marshall, of South Australia. Originally there were two varieties fixed from the same cross. They were known respectively as "Marshall's No. 3, White Straw," and "Marshall's No. 3, Purple Straw." In order to better distinguish between them, the variety with white straw was later named "Silver King," the variety with the purple straw retaining the original title of "Marshall's No. 3."

Marshall's No. 3 is rather more prolific than Silver King, though the latter is the more rust-resistant.

Marshall's No. 3 is fairly rust-resistant—a quality which it derives from one of its parents, Ward's Prolific—but it is smut liable. It prefers cool to hot districts, and in the latter the grain rarely fills well.

As a milling variety it belongs to the "Soft White" class.

Medeah.

Medeah is one of the macaroni varieties. It is an erect, tall-growing, late variety, which stools very scantily. When young, the growth is slow and spreading, and of a poor pale green colour. The flag is rather scanty, and the leaves of medium width and inclined to be stiff. The straw is strong and solid near the ear; it is dull yellow, with prominent joints. The ears are long, and taper slightly from base to tip. They are heavily bearded and flat, and usually hang pendant over the stalk, being in this position because of their weight. The beards, the colour of which is either brown or black, are very rough and long. The chaff is smooth and red, inclining to black, and adheres firmly to the grain, thus preventing shelling. The grain is long, thin, and angular, sometimes horny, but is often opaque or parti-coloured.

Medeah is one of the most prominent of the varieties grown in Algeria. In South Australia this variety is also known as "Indian Runner." It possesses the three excellent qualities of drought-resistance, rust-resistance, and smut-resistance. It is so rust-resistant that it can be grown near the coast, and is very valuable for greenstuff or silage.

In the grain districts, this variety is very valuable for producing a crop for silage. It is capable of producing, under ordinary conditions, from 8 to 10 tons of green stuff per acre.

Unfortunately, its harsh rough beards render it quite unsuitable for hay. These beards are serrated like a saw, and, when dry, lacerate the mouth of the animal eating them. They also render the variety unsuitable for stripping, and cause considerable irritation on the bodies of the men thrashing a crop of Medeah.

At present it is considered smut-proof, for the crop produced from sowing badly smutted and "unpickled" grain has always been a clean crop.

A satisfactory way of dealing with this variety on the coast is that recommended by Mr. Valder some years ago, viz.: Plant it early, and then utilise it in early winter (June–July) for soiling or grazing, and afterwards allow the second growth to mature for grain. The grain makes excellent poultry or stock feed, but is unsuitable for milling, and of inferior quality for the making of macaroni.

Rymer.

Rymer is a mid-season, erect, tall-growing variety which does not stool heavily. The young growth is fairly vigorous, slightly prostrate, and has rather a good colour. The foliage is not abundant; the leaves are stiff, narrow, and erect. The ripe straw is white, not very stiff or stout, hollow, and somewhat slender. The ears are inclined to be pendant, and are yellowish-white and fairly long; they are tapering, with very slight tip-beards, and with the spikelets not set very closely together. The chaff is white, smooth, and open. The grain is white and rather plump.

Rymer is the result of a cross between "Improved Fife" and "Purple Straw." It is one of the few Purple Straw crosses that have proved worthy of being fixed. It is suitable for early and mid-season planting in warm, dry districts, and is a good yielder of both hay and grain. The ripe crop is very level-headed and is admirably suited for stripping; it strips easily, but is not inclined to shed. It is slightly rust-resistant but is smut liable, and is subject to attacks of aphis. It is not suitable for rich soils.

As a milling variety it belongs to the "Soft White" class.

Steinwedel.

Steinwedel is an early, rather erect, free-stooling variety, of medium height. The young growth is vigorous, of rather a pale colour, and is spreading rather than erect. The foliage is abundant, with the leaves limp and drooping. The straw is purple, stout, and strong. The ears are large, full tipped, and tip-bearded, with the spikelets open and rather irregularly placed. The chaff is white, smooth, and loosely attached to the grain. The grain is fairly large, white, and plump.

Steinwedel is a selection from South Australia, made by a farmer of the same name, from a crop of Farmer's Friend. It is somewhat like the latter, but the late Mr. Wm. Farrer found that "there are constant but unimportant differences between the two varieties."

Fig. 13.—Rymer. **Fig. 14.—Steinwedel.**

Varieties of wheat recommended by the Department of Agriculture.

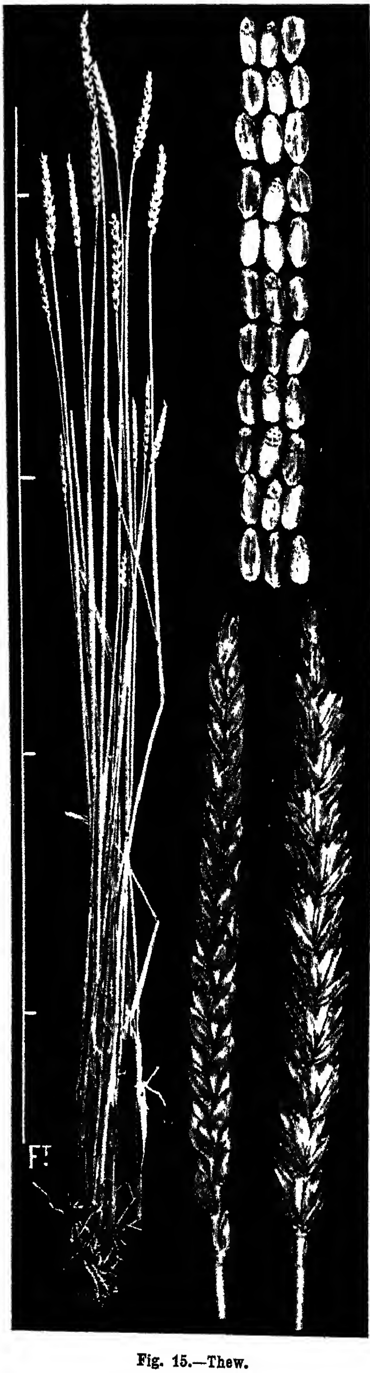


Fig. 15.—Thew.

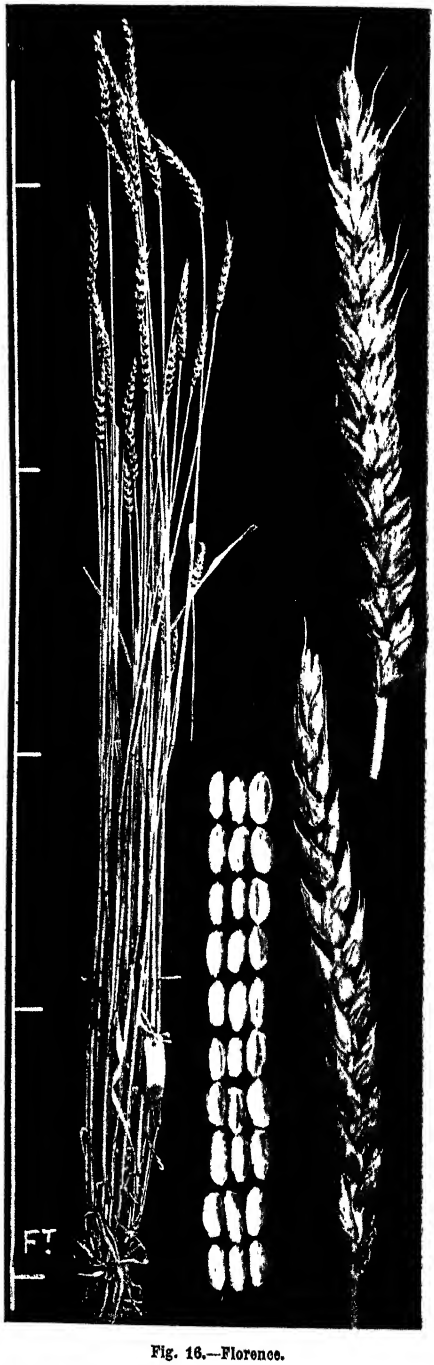


Fig. 16.—Florence.

Varieties of wheat recommended by the Department of Agriculture.

Steinwedel is very rust and smut liable.

This variety is highly drought-resistant, and up to the present has not been surpassed by any other variety for the production of fodder in the hottest and driest parts of the State. It resists drought better than Allora Spring. It is also a prolific yielder of grain, but is extremely liable to shelling, and for that reason the grain crop must be harvested with the reaper and binder, and just at the right stage, or the risk of loss is very great. Under average conditions it produces a heavy grain of bright, attractive, plump appearance.

As a milling variety it is below the standard of strength set up by the Department. It produces a large percentage of white, starchy, weak flour.

Thew.

Thew is very early, medium tall, and a fair stooling variety. The young growth is vigorous, rather spreading, and of good colour. It has a medium amount of foliage, which is green to the base of the plant. The leaves are rather stiff and narrow. When ripe the straw is white, not very stout, and inclined to be weak under good conditions. The ears are beardless, of medium length, and tapering, with the spikelets fairly open. The chaff is white, smooth, and not very close. The grain is white, not very large, and only fairly plump.

Thew is a cross-bred, with pedigree as follows :—

Sinew × Improved Fife   Improved Fife × Hussar
Unnamed × Unnamed
C (F) × Unnamed
Thew.

It is a particularly early variety, and seems to suit the coast districts. Its extreme earliness probably enables it to escape rust rather than that some constitutional ability enables it to resist the pest, for in some districts it has been reported as rusty.

Its soft straw, and habit of carrying green foliage right to its base, render it a very suitable variety for hay.

This variety is recommended for hay and greenstuff in the coastal and similar rusty districts. Though it has yielded well in some of our grain districts, it is not recommended for them, as there are other varieties quite as prolific and of better milling value.

The strain now being cultivated belongs to the "Soft White" class. Some of the other original strains of Thew were of superior milling value, but have given place to the present one, which has proved most suitable for rust conditions.

Florence.

Florence is a very early variety, of medium height, which stools well. The young growth is of a good, dark colour, vigorous, erect and compact. The

foliage is of medium quantity, with rather stiff, narrow leaves. When ripe the straw is white and rather slender, The ears are slightly tip-bearded, of medium size, and tapering. The spikelets are not set very closely together. The chaff is white, smooth, and rather open. The grain is good, white, fairly large, and inclined to be plump.

Florence is a cross-bred, produced as the result of a successful effort made to obtain a smut-resisting variety. Its pedigree is as follows :—

White Naples × Improved Fife
Unnamed × White Naples   Improved Fife × Eden
Unnamed × Unnamed
Florence.

The cross was made in 1901, and introduced into general cultivation for trial in 1907. It is, therefore, a comparatively recent variety. The introduction of Florence, and its sister variety, Genoa, into cultivation, marked a distinct stage in the history of wheat-growing in New South Wales. With their advent the production of smut-resisting varieties has passed the experimental stage, and has been brought within the range of practical agriculture. In the future we may reasonably expect to have all our standard varieties bunt-resistant.

Florence is specially remarkable for its ability to resist the attacks of smut (bunt). In the severe tests to which it has been subjected, the crops resulting from heavily smutted seed have proved to be almost entirely free from smut. At present it is not known whether this freedom from smut is due to some inherent constitutional character, or whether it escapes because of some peculiarity of the germinating process. From a farmers' standpoint this is not an important matter. The item that is of value to him is that crops of Florence, resulting from heavily smutted but untreated seed, have been free from smutted grain.

Florence is suitable for hay or grain ; it is a very prolific yielder of grain, but with the grain held so loosely that it is apt to shell. This is apparently not the case in every district, for some reports to hand make no reference to this defect. It is very early, and unless it is to be fed off, should on no account be sown till mid-season.

As a milling variety the grain is of satisfactory quality, and belongs to the "Soft White" class.

(*To be continued.*)

Experiments with Fungicides for the prevention of "Stinking Smut" or "Bunt" in Wheat.

[PRELIMINARY NOTE.]

We have received from Mr. Geo. L. Sutton, Wheat Experimentalist, details of results of experiments conducted by him at Cowra Experiment Farm last year for the prevention of "Stinking Smut" or "Bunt." These results will be published in our May issue; but as many of our readers will be pickling their seed grain this month we give a summary of Mr. Sutton's recommendations.

The following fungicides were experimented with:—

(1) A one-quarter (¼) per cent. solution of Formalin;
(2) A two (2) per cent. solution of Bluestone;
(3) A two (2) per cent. solution of Bluestone supplemented by immersion in Lime-water;
(4) Bordeaux Mixture;
(5) A two (2) per cent. solution of Bluestone, to which was added sufficient Salt to make a saturated solution;
(6) A saturated solution of Common Salt and water;
(7) "Fungusine," a proprietary preparation.

Mr. Sutton summarises the results of the experiments as follows:—

The absolute necessity for the removal of unbroken bunt balls from the seed grain before "pickling" it, is emphasised.

BLUESTONE, as formerly, proved to be a splendid preventive of "smut," and also satisfactory in preventing re-infection; but it also, as formerly, proved to have a very disastrous effect upon the vitality of the seed grain treated with it. This year 30 per cent. of the seed grain was destroyed by the bluestone treatment. It is therefore advisable to use some ameliorating agent with it, and for this purpose lime and salt are recommended.

Allowing the grain to remain in the bluestone solution for longer periods than five minutes did not increase the destructive action of the bluestone, nor increase its efficiency as a smut preventive.

BLUESTONE AND LIME.—This was not as satisfactory as bluestone, as a bunt preventive, nor in preventing re-infection; but its destructive effect upon the vitality of the seed was very much less. As the result of supplementing the bluestone treatment with lime water, some 20 per cent. of the grain was saved.

When using this treatment it is advantageous to delay the treatment with lime water, rather than to treat the seed immediately after bluestoning. The effect of delaying the supplementary treatment is in the direction of increasing the efficiency of the combined treatment, without increasing its destructive effect upon the vitality of the seed.

BLUESTONE AND SALT proved the most effective preventive of bunt tried this season. Salt was better than lime in lessening the destructive action of bluestone upon the vitality of the grain. It was also best in preventing re-infection, but the results in this respect are disregarded for the present, because of what in the future may prove to be an irregularity.

Bluestone and Salt is recommended as a farmers' treatment for the prevention of "smut."

FUNGUSINE, though not quite fulfilling its description as "infallible," has proved in this trial to be very satisfactory. As a smut preventive it is not quite as good as Bluestone, but rather better than Bluestone and Lime. It has absolutely no injurious effect upon the germination of the seed, but rather protected it from the attacks of unseen grain pests. For preventing re-infection it was not as good as Bluestone, but very slightly better than Bluestone and Lime.

It was the best all-round method tried this year, and if it maintains this position in future experiments it will displace bluestone in any form as the most satisfactory for general adoption.

BORDEAUX MIXTURE did not prove satisfactory as a bunt preventive, nor in preventing re-infection. It had practically no injurious effect upon the vitality of the seed grain.

FORMALIN this year did not prove satisfactory in preventing smut, but this is considered due to an abnormal irregularity. It was of little value in preventing re-infection. In this trial, when the conditions for germination were good, it had practically no injurious effect upon the germination of the seed.

SALT WATER proved unsatisfactory as a bunt preventive. It had not a very destructive effect upon the seed grain—in this respect it was about equal to Bluestone and Salt. This treatment may be considered as being entirely unsuitable and ineffective.

Seed may be treated with Bluestone, Bluestone and Lime, or "Fungusine" at least three months before it is required for planting.

Mr. Sutton thus recommends treatment with Bluestone and Salt. Bluestone is dissolved in water at the rate of 2 lb. of bluestone to 10 gallons of water. Two lb. of common salt is then added to the bluestone solution. The seed is placed in a suitable vessel and the solution poured over it. The seed is then stirred to ensure that every grain is thoroughly wetted.

After it has been immersed for five minutes, the solution is poured off and the seed dried.

"Fungusine," from which such good results were obtained, was used by Mr. Sutton in accordance with the directions supplied by the proprietors.

Two lb. of salt is suggested for adding to the bluestone solution, pending the result of further investigation. The present experiment demonstrated only that as much salt as the bluestone solution will absorb can be added without risk of injury. The most economical amount to add for best results will be ascertained by future experiments.

PHALARIS COMMUTATA (SO-CALLED).

W. FORSYTH.

DURING a recent botanical collecting trip to Delegate and the surrounding district, my attention was drawn to successful experiments which had been made with the grass *Phalaris commutata.*

Mr. Alcock, book-keeper at Messrs. O'Hare's station, Currawong, explained to me that he had seeds of this grass sent to him for experimental purposes from Messrs. Anderson & Co., seedsmen, of Sydney. Satisfied with the way it had thriven in his garden, he collected a quantity of the seeds and gave them to Mr. Cameron, who lives near Merambego. Mr. Cameron, with those seeds, sowed a patch measuring about 40 yards x 20 yards. From the grass grown on this small piece of land, he fed 40 hoggets and 3 cows nearly all winter. The stock were not allowed in the enclosure, the grass being cut and thrown over the fence to them just as lucerne or green barley would be.

Mr. Alcock was emphatic in stating that the blue variety (presumably *P. cœrulescens*) of the grass is almost useless, as it makes growth for a short time only after rain, but that the variety *commutata* thrives well in dry weather and especially in the winter time, and he would like that the success obtained in these experiments might be made known, so that other stock owners, on the Monaro especially, may profit by it.

The Dairying Industry.

M. A. O'CALLAGHAN.

Manufacture of Butter—(*continued*).

Cleanliness.

There is no word in the English language which represents the idea of the individual who uses it more than does the term "cleanliness." Cleanliness has a different standard in the minds of different people according to the professions or trades which they follow, and according to their experiences in the evils which occur from any want of it in their particular pursuits. The dairy premises which the ordinary agriculturist may consider clean may be considered very unclean by the specialised dairy farmer, and, on the other hand, what the advanced dairy farmer may consider clean would not pass muster with a medical inspector, who would have in view the supply of milk for children. Again, a vessel or room which the ordinary educated man might consider perfectly clean, would be deemed unclean by a surgeon. In Japan no person is allowed to enter a warehouse or private dwelling until he has removed his boots, this latter service being performed for him by an attendant who waits at the door. This goes to show that this very ancient race has its own standard of cleanliness, as far as the feet are concerned. Again, a man in a rough suit would possibly consider a seat clean which a lady wearing a white linen dress would look on as filthy.

In the same way, the dairy premises which a slovenly dairyman may consider perfectly clean may be looked upon as dirty by a dairy inspector or a dairy instructor, who knows only too well the ease with which dairy products are contaminated. Such premises are to his mind what the seat is tothe mind of the dainty maid in the white linen dress; but the dairy farmer who is not acquainted with the evils of even slight uncleanliness will be no more particular in regard to his premises and utensils than was the man in the rough working suit in his inspection of the seat he was about to occupy.

Hence dairy cleanliness must perforce be a matter of education in dairying affairs. It is rather difficult to blame the farmer for having bails somewhat unclean, if you know that he does not understand the necessity for a greater degree of cleanliness. We may make dairy laws, and we may send forth inspectors to see that those laws are observed, but until our farmers on the whole get a better understanding of the ease with which dairy products, especially milk and cream, are contaminated, we shall not find that cleanliness observed which would lead to the very highest results in the manufacture of dairy products. Recently I visited a large dairy farmer, who showed me over his premises, and when he came to the yards and bails, he remarked, "Everything here is all right, isn't it?"—notwithstanding the fact that the floor of the bails, which was of concrete, had been brushed only just where

the cow had been standing, and dried manure had been allowed to form a coating on a large part of the floor. Although it was 2 o'clock in the afternoon, the cattle droppings from the previous milking time had not been disturbed, nor was there any evident intention of cleaning those yards before the next milking took place. Still, that man had no idea that his premises were in an unclean state, nor that the conditions were in reality such as would cause his cream to be of an inferior flavour when delivered at the factory. When his utensils were thoroughly clean and the bails sufficiently so for *milking purposes*, his standard of cleanliness was reached.

In dairy work on the farm we must have at least three standards of cleanliness—one for the dairy utensils, viz., the milking pails, the separator, cream cans, &c.; a second standard for the small dairy in which the milk is allowed to stand before separating and the cream to remain after separating until it is taken to the factory; and a third standard for the cow bails and yards.

In the first mentioned, viz., that of the utensils, we must have *scrupulous cleanliness*. Absolute cleanliness, or bacteriological cleanliness, we cannot have, nor can we expect it, but we can have, and we should have, that form of cleanliness which is procurable by the application of boiling water and clean cloths and brushes. The necessity for thoroughly cleaning the separator *after each separating* should not be lost sight of. Some farmers think it unnecessary to clean the separator after the evening's work, but long before the morning's separating is begun the refuse left behind from the previous evening will have advanced considerably towards decomposition, and will contaminate the milk and cream which is introduced into it next morning.

In the dairy proper, or separating room, we must have that degree of cleanliness on the walls and shelves which is practically possible, but we cannot reach that high standard of cleanliness which is easily procurable in the dairy utensils. However, one thing we do know, viz., that if the surroundings of the dairy proper are clean in character, then the atmosphere of the dairy will not be contaminated, and the dairy products that are resting there will not quickly deteriorate.

If, on the other hand, we take a lot of pains in cleaning the utensils and the dairy proper, but neglect the yards and bails, a great deal of our work will have been done in vain, because *generally as are the yards and bails, so will be the atmosphere which pervades the dairy proper.* It is not practicable nor economical on a dairy farm to have the dairy proper so far removed from the bails and yards that the atmosphere common to the latter will not also be frequently common to the dairy. Undoubtedly, the atmosphere of the dairy will not be contaminated to as high a degree as that of the badly-kept yards and bails, but when the wind blows towards the dairy from the bails, then the injurious atmosphere common to the bails is transferred with its contaminations in the shape of particles of dust and dirt, to the dairy proper *and to the cream or milk therein.*

Standard of Cleanliness necessary in the Bails.

It may be accepted that, in the absence of a manure heap, the yards surrounding the bails are the main source of contamination in the atmosphere of the dairy premises. (It is here assumed, of course, that the piggery is sufficiently far removed from the dairy to prevent the odours therefrom reaching the separating room.) The cattle are milked in specially-built bails twice a day, and it is a very rare thing indeed to find cattle fed in these milking bails. Hence, as soon as milking is over, the animals are allowed to go into the paddocks and depasture there until brought to the next milking. While waiting their turn to be milked, not only in the yard proper, but immediately outside, the animals contaminate the surroundings of the milking yards to a greater or less extent, according to the size of the yards in proportion to the number of cattle. Small yards, with a large number of cattle therein, are contaminated quickly and considerably. But no matter whether the contamination is great or small, as soon as milking and separating are over, the next step in the morning's work should be to clean the milking bails and yards. The manure should be removed to a sufficient distance to prevent easy contamination from the manure heap to the milking bails or to the dairy proper. After the evening's milking, there is not so much time available for cleaning, but the bails and yards should receive a rough cleaning at least, so that they may be fit for milking in the early morning.

Cleanliness in the Factory.

The dairy factory should be a model in cleanliness, not only because of the absolute necessity for thorough cleanliness in connection with the ripening of cream and the manufacture of butter, but also for the express purpose of giving an object lesson to the farmers, and educating them, so to speak, by the force of example, in the way in which they should go. No matter how clean a farmer may intend to keep his own dairy and farm premises, he will undoubtedly get a set back and become careless if he finds that the factory where he takes his cream is not kept in a clean condition at all times. Farmers have occasionally complained to me personally of the want of cleanliness in factories to which they have sent cream; they say, and with a great deal of truth, that there is no use in their spending a lot of time and energy in keeping everything up to the highest mark of cleanliness when they find that the factory has an odour of uncleanliness.

The want of cleanliness in a factory frequently arises because of a lack of proper arrangements for the treatment of the waste waters or butter washings from the factory. It is well known that nothing gives forth a worse odour than decomposing dairy sewerage. There may be only a very small quantity of milk in the wash water that is allowed to pass away, but that small amount is quite capable of a decomposition sufficient to cause most obnoxious smells. Unfortunately, when a number of our factories were being erected, little or no attention was paid to the question of the best

disposal of the butter washings and floor waters, and as a consequence, now that the various local authorities have become more particular, many factories are in trouble on this point. It only requires the slightest soakage or overflow of milky waters on the ground close to the factory to, in time, cause a sour and unpleasant smell which will constantly pervade the air of the butter and cream-ripening rooms; and we may rest assured that if the odour referred to is present, undoubtedly the germs which are causing that odour will be present also, and will gain access to the cream vats almost at all times. Most factory managers also commit the error of allowing their butter-milk tanks to get into a very bad condition from a sanitary point of view; they know that no matter how sour-smelling the tank is, the farmer who purchases the butter-milk for his pigs will not object; and hence the daily cleansing of the butter-milk reservoir is not by any means a regular practice, except in a very few factories. This means that the decomposing residue of the butter-milk, which the farmer leaves, forms into a sort of slime on the tank, and the germs that are causing this decomposition are ever present in the atmosphere in and surrounding the factory. Needless to add, the germs that are decomposing the casein or nitrogenous portion of this old butter-milk residue, are not the germs that the man who wishes his cream to be properly ripened desires to have in his cream-ripening room.

If butter-milk tanks are not so arranged that they can be cleansed daily, they should be placed at a distance from the factory not less than 50 yards, so that any sour smell issuing therefrom may not taint the atmosphere of the room in which the cream is being ripened, or in which the butter is being made. For the same reason that the butter-milk tank, if not kept perfectly clean, should be situated at some distance from the dairy, the drain which conveys the floor washing from the factory should be made either of large earthenware piping or concrete for some distance at least, so that any needless water may not overflow on to the soil close to the factory, as this would result in foul odour pervading the immediate atmosphere.

Decaying Woodwork.

Some factories become, practically speaking, unfit for the manufacture of high-class butter, owing to the presence of decaying woodwork therein. Sometimes this decaying wood is portion of the floor of the cream room, but more frequently it is due to the wood which composes the walls of the cold room suffering from damp and decay. The mould growth, which causes this extensive decomposition of the wood, at the same time gives forth a very musty odour, and this is usually absorbed by the cream which is in the factory, and also by the freshly-made butter.

Another evil result of this form of uncleanliness is that the atmosphere of the factory becomes wholly contaminated by the seeds of the moulds referred to, and then little spores (or seeds) later on drop on the butter parchment, and when the butter is being sent to market these little seeds

grow into colonies of moulds, which in a little time become so large that the paper surrounding the butter is unsightly, and the butter itself assumes a mouldy flavour. Damp warm climates, such as that of the Northern Rivers, encourage mould growth so considerably that factories situated in these districts frequently suffer from this trouble.

Hop Waste as a Fodder.

Inquiries having been made as to the value of refuse hops from breweries as a fodder, Mr. F. B. Guthrie, Chemist of the Department, has furnished the two following analyses of such waste :—

1.—Water...	57·0 per cent.
Organic matter	40·0 „
Ash	1·3 „
Nitrogen	1·9 „
Phosphoric acid	0·8 „
2.—*An air-dried sample* :—	
Water...	10·0 per cent.
Ash	5·34 „
Nitrogen	3·31 „
The ash contains :—	
Potash	11·27 per cent.
Phosphoric acid	26·10 „
Lime	14·70 „
Magnesia	12·1 „

The waste is used as a fodder, but not extensively. As will be seen from the analysis it has no great feeding value, being about equal to medium quality clover hay. Its chief use in England is in the compost heap or in bedding animals and as a fertiliser. It is sometimes fed mixed with brewers' grains.

Fumigating Rabbit Burrows.

Those landholders who are compelled to resort to fumigation for the destruction of rabbits will be interested in the experience of Messrs. Conroy and Doyle, of North Bangaroo, Goolagong, who have found fumigating with bi-sulphide of carbon, and using a smoke mixture to detect air leaks, both cheap and effective. At the suggestion of Mr. F. B. Guthrie, Chemist of the Department, these gentlemen tried a smoke-mixture prepared from strongest ammonia at 4½d. per lb., and muriatic acid at 2d. per lb. The chemicals were placed in separate bottles and air pumped into the partly filled bottles. The air was then carried through and united in a single tube, the result being a heavy vapour, readily discernible and especially useful for detecting air escapes in warrens. Thus the bi-sulphide of carbon could be used with the best possible effect. The cost per gallon of each chemical was 2s. 6d. and 1s. 3d. respectively, instead of 15s. per gallon which some agents charge for chemical smoke-mixtures. Of course, the jars had to be returned and freight paid.

INSECTIVOROUS BIRDS OF NEW SOUTH WALES.

"HOODED ROBIN"; "BLACK AND WHITE ROBIN.

MELANODRYAS BICOLOR. *Vig.* and *Horsf.*

Insectivorous Birds of New South Wales.

NATURE has provided the Australian farmer and fruit-grower with many enemies in the animal, vegetable, and mineral kingdoms. Several injurious substances appear in places in the soil, and render it unfertile; various fungi and weeds insidiously find their way into his crops to absorb the plant-food and feed upon the tissues of his produce; and an infinite variety of insects prey upon his fruits and crops. In combating these enemies he has drawn upon all the resources of the chemist, the pathologist, the micro-biologist, the entomologist, and the manufacturer; and the struggle, sometimes successful, sometimes futile, has brought out in him the noblest qualities of his ancestors—courage, patience, determination, endurance.

But Nature has proved herself his friend; for when he has conquered and controlled these enemies, indigenous and exotic, the soil generously repays his labours. Nature has also proved herself his friend by providing enemies for his enemies—friends of his who bear his banner in the little world and fight right valiantly on his side. What if he and his children, in wanton so-called "sport," have attacked these friends and destroyed them, broken up their homes, slain their little ones, and often almost annihilated their race?

The most powerful group of enemies which the farmer and the fruit-grower have to face are injurious insects. Breeding in the trees and crops, the soil, or the wild bush, these little creatures attack the foliage and fruits, and, if unchecked, would soon render all forms of agriculture unprofitable. Legislation has been directed against them, machinery has been provided to destroy them, chemical science has invented weapons to attack them, and farmers have laboured arduously towards their extermination. But, meanwhile, throughout the continent, Nature has distributed many species of birds which prey upon them for their food, and at the same time do not interfere with the crops or fruits which must be protected from them. These birds are clearly the farmers' friends; but these birds are often ruthlessly shot or trapped; their eggs are sought by school boys; and unless a warning be heeded in time many of their species will soon be extinct.

The Department of Agriculture, being desirous of disseminating information respecting these useful birds, has arranged for the reproduction of plates of some of the most widely distributed insectivorous birds from Gould's famous "Birds of Australia"; and these will be shown in the *Agricultural Gazette* as they are prepared. Every bird shown is insectivorous, but neither granivorous nor frugivorous—lives upon insects, but does no harm to crops or fruits. Our readers should take the plates out of the *Gazettes* as received, and frame them in groups. They are the farmers' friends, not to be destroyed, not to be driven from the orchards or crops, but to be encouraged

and welcomed as the allies which Nature has provided to the farmer in his fight with his enemies. Every Australian boy who aims his pea-rifle or catapult at a bird whose picture appears in this series is unworthy of his country; and every Australian boy who has in his collection the eggs of one of these birds is as much an enemy of Australia as if he took arms to assist an invading force, which no Australian boy would do.

In compiling the information supplied with each plate we are indebted to Mr. A. J. North, F.L.S., Ornithologist of the Australian Museum, whose courteous assistance we desire to acknowledge. We have also made use of Mr. A. J. Campbell's two volumes of "Nests and Eggs of Australian Birds," and several other publications.

In this issue we give plates of two birds—the "Hooded" or "Black and White" Robin, and the "Yellow-breasted" Shrike Robin.

1. Hooded Robin or Black and White Robin.

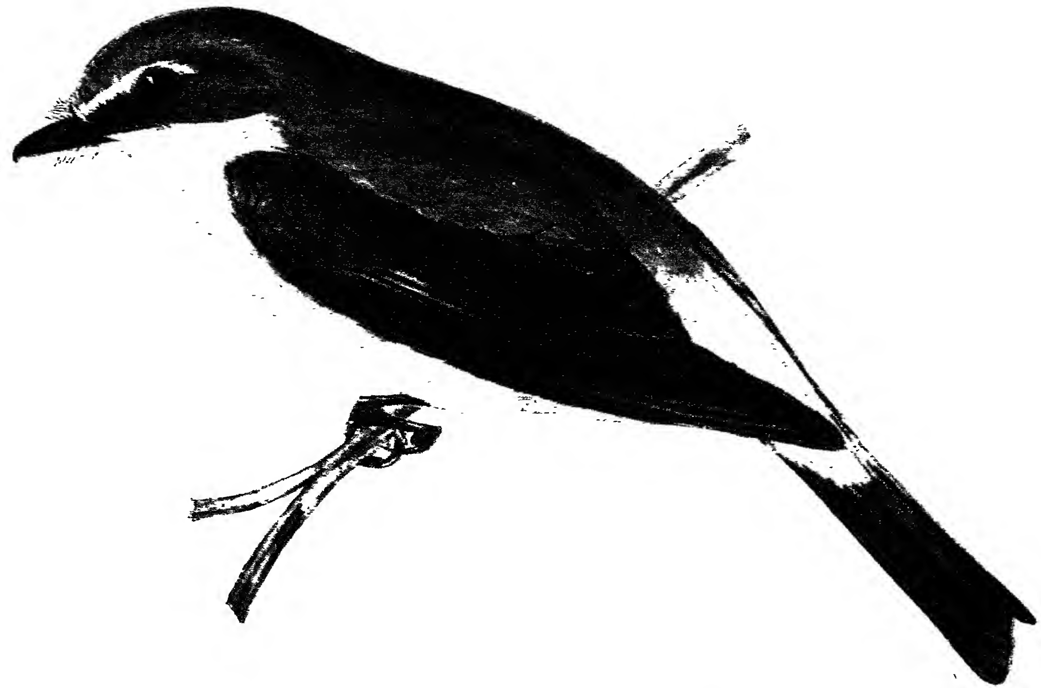
Though not so readily recognised as its little red and yellow-tinted cousins, the Black and White Robin is found all over New South Wales, with the exception of the districts very close to the coast. It may be met with on the wooded flats and open forest country between Blacktown and Penrith, and on the Blue Mountains, but it is far more freely distributed in the low pine scrubs of the interior. The head is black, the rest of the plumage black and white. The female is brownish-grey. (See plate.) In both sexes the eyes, bills, and feet are blackish-brown. Total length of bird, 6 inches.

This little robin may be heard chirping in its low mournful voice, in small timber throughout our inland districts. It builds its nest in the dead forked branch of a standing or fallen tree, a few feet from the ground, in a hollow part of a tree, or sometimes in a thick bush in open forest. The nest is cup-shaped, neat, open, and shallow, made of strips of soft bark, protected outside with bark or fine twigs and grass attached with spiders' web. It is usually lined inside with fine wiry grasses. The eggs, two or three in number, are much pointed at one end, olive or apple-green in colour, but frequently washed or spotted with reddish-brown on the larger end. The birds breed from July to December, but generally about September.

The principal food of the Black and White Robin is composed of beetles and their larvæ. The orchardist knows the damage which borers, elephant beetles, and others do to his trees and fruits; the market gardener knows and dreads the pumpkin beetle; and numerous other beetles injure and destroy crops and fruit. Here, then, is a little feathered friend unconsciously helping the man on the land by devouring his enemies. Are we wrong in appealing to men and boys to spare and protect him?

2. Yellow-breasted Shrike Robin.

Many of our coastal readers may not have met the bird described above, but every boy knows the "Yellow Bob." It is freely distributed over the greater portion of eastern New South Wales. It is very common in the scrubs



Insectivorous Birds of New South Wales.

"YELLOW-BREASTED ROBIN."

EOPSALTRIA AUSTRALIS, *Latham.*

near the coast, and is equally plentiful in the damp and humid gullies of the heavily-timbered mountains.

Mr. Campbell, speaking of this bird, says:—"Of all the feathered forest friends I know of none more attractive than the confiding and shapely Yellow-breasted Shrike Robin. Enter any quiet sylvan nook or deep gully for a while, and there one of these dear birds will surely detect your presence, and alighting in a pretty attitude on a twig or clinging sideways to the bark of some tree stem near, will watch your movements. Their lovely nests, too, as forest ornaments, are extremely beautiful."

The bird, if not already known, will be readily recognised from the plate. The male and female are very similar, except that the male possesses the larger bill. The nest, usually placed in the fork of a low tree, is round and cup-shaped, composed of strips of bark and fibrous roots, bound together with cobwebs. The outside and rim are beautifully ornamented with lichen and pieces of bark attached by means of cobweb, which hang perpendicularly around the nest. It is lined inside with wiry grasses, and generally has a few dried eucalyptus leaves at the bottom. The eggs, two or three in number, are bright apple or bluish-green ground colour, freckled and spotted all over with different shades of reddish and chestnut-brown. These markings sometimes predominate towards the thicker end, and become confluent. Near Sydney this species is one of the first to breed, commencing early in July, and continuing until the end of December, two or three broods being raised during the season.

Probably there is no more familiar or useful bird to the orchardist and viticulturist. It destroys caterpillars, moths, butterflies, beetles, and particularly scale insects.

Mr. Hermann Lau, speaking of the bird in South Queensland, wrote:—

"It is early morning, just as the dawn is approaching. Lying half awake, half dreaming, in my lonely tent close behind the palm wold of Cooyer Scrub, I hear a fine, equal, oft-repeated note in the thicket, as if heralding the golden sun, and which fills my heart with thankfulness to my great Creator. The notes emanate from this dear little bird, which also sings its psalm of praise to its Maker at early dawn. (*Eopsaltria*, the bird's generic name, literally means 'Psalm of dawn.')" As it is one of the first to awake and sing, so it is one of the last of the diurnal birds to go to roost, and its note, "cheop-cheop," may be heard in the gathering twilight.

If you wish to remove something that is beautiful and useful in the native life of the bush, please destroy this little bird; but if you wish to leave to future generations of farmers and orchardists a pretty, pleasing little companion, and an invaluable friend in their work of providing the world's food supply, then hands off the eggs of the "Yellow Bob."

(To be continued.)

Bush Fires.

"LOCKING the stable door when the pony is out" is an old expression for the action of those who take preventive measures against unfortunate occurrences when the damage is done; but if the pony is to be recaptured, or if the stable is to be used for other equine stock, the man who puts a strong inexpensive fastening upon the defective door is acting wisely.

Although the damage for this past summer from bush fires is now complete, we may safely predict that next summer will see a recurrence of the danger. Nearly every Christmas in New South Wales is heralded by reports of more or less extensive damage to grass and crops by bush fires; and the question of precautions against, and methods of dealing with, these outbreaks are of the utmost personal importance to farmers and settlers in warm districts. The following table, compiled from the Statistical Registers, shows the actual losses of crops which have been reported to the Government Statistician for the years given. No official record has been preserved of the enormous areas of grass destroyed. When it is remembered that these losses have occurred in spite of the most heroic exertions on the part of those interested, it will be seen how necessary it is that steps should be taken to prevent these outbreaks, or effectively deal with them when preventive measures have failed.

TABLE showing Destruction of Crops by Bush Fires in New South Wales.

Crops.	1900.	1901.	1903.	1904.	1905.	1906.	1907.	1908.
	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.
Wheat (grain) ..	14,422	4,054	2,161	41,776	9,944	745	250	...
,, (hay).....	2,316	165	...	4,497	490	140	250	25
Maize..	12	...	15	799	...	...	...	15
Barley (grain) ...	605	60	14	13	...	...	...	..
,, (hay)......	...	...	...	5	...	...	...	...
Oats (grain)	20	70	3	967	...	...	...	...
,, (hay).........	107	19	...	1,827	...	...	...	2
Lucerne............	4	40	...	387	...	...	...	...
Fruit	2	144	...	199	...	46	...	29½
Other Crops	...	51	...	253	2	...	2	6
Total area ...	17,488	4,603	2,193	50,723	10,436	931	502	77½

Figures were not tabulated for 1902, the year of the great drought. It will be noticed that since the great disasters of 1904–5, there has been a continuous decrease in the areas affected; but the figures for 1909, when available, will show a recurrence of the widespread damage of former years. In good seasons, following a plentiful rainfall in spring, the well-grown crops and grass turn brown at the first touch of summer, and soon provide a mass of highly inflammable material waiting for a spark or match; consequently settlers may look for danger from fire in such seasons, and make preparations accordingly.

Preventive Measures.

The necessity for individual effort in taking precautions against bush fires is now generally recognised; but as every bush fire, however small, is a menace to the whole district in which it is situated, until it is completely extinguished, and as often no person is actually or directly responsible for the breaking out of a bush fire, collective effort should supplement individual effort. This will require to be done if fires are to be confined to a more or less limited area around the point where they break out, and the devastation of the whole countryside is to be prevented.

As all landholders in a district are not equally unselfish, and because "everybody's business is nobody's business," such collective effort, to be equitable, reliable, and available to all when needed, will require to be compulsory and governed by some central and public body. Mr. James Smith, of Cowra, suggests that the proper authority to control this work is the Shire Council, who should be given power to levy a small rate to cover the cost of administration upon something like the following conditions:—The council should be required to equip and maintain a bush-fire brigade in its shire. This brigade would consist of a number of companies, each provided with a fire-fighting cart and other suitable equipment, stationed at different centres throughout the district. The members of such a brigade might be enrolled in a similar manner to our partially-paid military forces. In the event of a fire breaking out within a given radius of any station, the company belonging to that station, under the officer in charge of the fire-fighting cart, would be required to proceed to the seat of the fire and render such assistance as they could.

In order to ensure prompt attendance of the bush-fire company at the outbreak of a fire, each member attending should receive a liberal wage whilst on duty. The company would be required to stay on duty at a fire until the logs and any other inflammable material had been extinguished, and until the officer in charge was satisfied that the burnt area was no longer a source of danger.

Individual Precautions.

But while collective efforts are necessary to cope with this menace to the whole district, the individual farmer should not lose sight of the fact that if these methods fail he will be the sufferer, and he should take all possible precautions to protect his own holding.

A fire-fighting cart should be maintained in readiness for use. There are several makes on the market, or one can be fitted up on the farm. The tank pump, with air-chamber and hose, must be procured, and these can be fitted on almost any kind of vehicle.

A fire-break at least half a chain wide should be provided around all ripe crops. One of the simplest methods is to cut a strip around the various paddocks, afterwards ploughing a few rounds with a multiple plough before the wheat gets ripe. Another method is to plough two strips of three

furrows each, half a chain apart, and fire the intervening section of grass, using the fire-carts to see that the flames do not extend beyond the ploughed boundaries of the burnt area.

Wherever possible, the ripe grain crops may be protected with a cultivated or green crop on their boundaries, or by separating portions of the grain crops from each other by cultivated or green crops. A narrow strip of lucerne, if the soil is suitable, would be profitable, or potatoes could be grown; in fact, any crop which would be green while harvesting is in full swing. These crops could be utilised remuneratively without interfering with the economic working of the holding.

No grain crops should be grown within 2 chains of any building, and the ground should be kept as clear of grass as possible. In spring it is nice to have nature's carpet right up to the doors; but when the grass has grown rank and dry in the summer-time, and the fire is bearing down upon the property, the danger is evident.

Buildings should be surrounded with a belt of shade trees, growing on ground kept free (by cultivation) from grass and herbage. The grass growing between the buildings and the trees should be kept eaten down. Buildings may also be afforded additional protection by having a flower border around them. On the danger side they may be surrounded with a cultivated orchard or cultivated green crop.

If the suggestion made above with regard to Shire control be adopted, individual efforts on the part of settlers would be encouraged by allowing, as a rebate, a portion of the rate levied for fire-fighting purposes to those who, in the opinion of the Council, make adequate provision within their holding against the outbreak and spread of bush fires.

Fighting the Flames.

Assuming that all these precautions, collective and individual, have been taken, the settler may rest fairly secure against the danger of fire; but still, on a day when a hot northerly or westerly wind is blowing, he should be prepared to see the fire-demon sweeping across the plains, and should be on the alert to protect his property. It is then that the organised bush-fire brigade will demonstrate its utility. At the first report of an outbreak, the local company will quickly mobilise and attack the flames, under the control of a responsible, experienced leader. There seems little doubt that, under present circumstances, the area of large outbreaks is extended as the result of excited persons, in their well-meaning zeal, lighting fires to act as breaks, which are not only useless but positively dangerous, and the cause of fresh outbreaks. But under the suggested scheme the burning of fire-breaks would be controlled by the leader of the company, who would understand the nature of the action and its results in each particular case. The principle is a sound and practical one, but its successful application requires intelligent control. The organisation and training of the company will also prevent the useless running about and shouting which usually characterises the more excitable portion of a scratch fire-fighting army at the present time. For

an individual to attack an extensive bush-fire on a hot windy day would be undertaking an impossible task; the unorganised, well-meaning efforts of a crowd of excited men at present have often very little better result. No nation would dream of sending an army into battle without training and drill; and the successful combating of a bush-fire requires as much cool-headed, intelligent, organised action as does a military operation.

The Law.

It may not be out of place to conclude this article with a brief resume of the legal provisions now in force in New South Wales for the prevention of bush-fires—provisions honoured largely in the breach, because they are not known to the unthinking offender—and dealing with offences which go unpunished because of the difficulty of detection.

Two statutes are at present in force—the "Careless Use of Fire Act, 1901," (consolidating), and the "Careless Use of Fire (Amendment) Act, 1906." The joint effect of these two Acts may be summarised as follows:—

(1.) For igniting, or using or carrying when ignited, any inflammable material within 100 yards of any stack of corn, pulse, or hay, or standing crop in an inflammable condition, or within 10 yards of a growing crop, stubble-field, or grass in an inflammable condition, or within 25 yards of felled timber awaiting a running fire, whereby the property of another person is endangered, injured, or destroyed, a penalty of £50 or three months' imprisonment is provided. But one may burn off straw, stubble, grass, or herbage, or ignite wood, or other inflammable material, after clearing of inflammable substance a space at least 66 feet in breadth around the proposed fire, and giving twenty-four hours' notice in writing to adjoining occupiers. This privilege, however, is not allowed during certain months in specified shires, as fixed by regulation. Between 5 p.m. and 4 a.m. grass may be burnt, except during the months named, after giving the notice to adjoining occupiers.

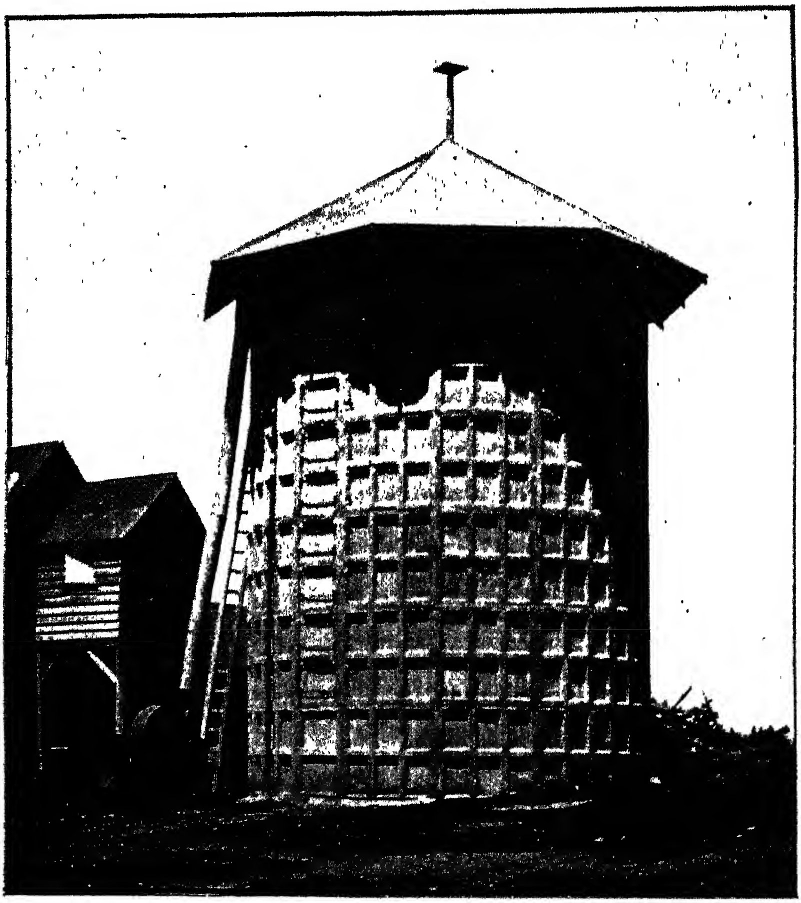
(2.) For leaving, temporarily or otherwise, a fire in the open air before it is thoroughly extinguished, the penalty is £50 or six months' imprisonment.

(3.) If an occupier clears his land of inflammable materials for a space of 20 feet from his dividing fence, his neighbour must do the same; otherwise, if the fence is damaged, the defaulting occupier must repair the fence at his own cost.

(4.) The Governor is empowered to make regulations prohibiting the sale or use of other than safety matches in any specified locality, under a penalty of £10. The prohibition has been extended to most of the Shires in the south-western portion of the State.

A Portable, Sectional, Reinforced Concrete Silo.

An application for a patent for a portable reinforced concrete silo has been made by Mr. E. G. Stone, 11 Moore-street, Sydney, who exhibited one of the silos at the recent Royal Agricultural Show. The Department gives the description of this new form of silo in the patentee's own words, and recognises points of possible value in it. The one already built, and others shortly to be erected, will be closely watched by the Department, and the results duly



Portable, Sectional, Reinforced Concrete Silo.
Patent applied for by E. G. Stone.

published for the guidance of farmers. The use of reinforced concrete is steadily growing in Queensland, Victoria, and our own State, in those districts in which the gravel and sand are readily obtainable; and a number of silos constructed of this material by the aid of skilled labour are giving satisfaction. In certain districts they may be erected as cheaply as wooden tub silos, and are probably much more durable.

"The reinforced concrete silo has found a place, to be retained, it seems, permanently, amongst its competitors, the obvious advantages of reinforced concrete being its permanent nature, indestructibility by fire, white ant, or any of the decays that attack timber and similar materiar. Added to this, as mentioned in a previous article, 'Ferro-Cement Silos,' in 'Farmers' Bulletin,' No. 6, p. 66, there is no upkeep to be provided for. Many of the reinforced concrete silos have been built to the plans mentioned in that article in various parts of the State, and apparently are very satisfactory. But the difficulty that has been met with is that such construction demands expert workmen. In one or two cases where men were sent away who could not be supervised, inferior work was the result. So much so that it very soon became apparent that either this type of construction would have to be thrown on one side or else a higher price charged for personal supervision. To obviate this, the silo mentioned above has been designed, and a patent applied for. The great advantage in having a silo made in this way is that expert hands can be trained, who will work in a factory under expert supervision, to specially prepared designs. This gives an almost certain opportunity to obtain success.

"A description of the silo is as follows:—Reinforced concrete plates are moulded in sections weighing from 3½ to 5 cwt., according to the type and size of the silo. The steel is so placed that all the bursting stresses are turned into the plates themselves, and also where the flanges are fastened by the bolts which are the main method of fastening adopted (although other forms of fastenings are also patented), these bolts are so placed that when the bursting stress comes on the silo it is transferred from the bolts to steel rods, and the resistance is continuous right throughout the circle.

"Obviously the first question that will be asked is 'What is the freight to be paid upon these sections?' It may be placed on record that the Railway Commissioners, on being approached, at once decided to meet the farmers, and have given the lowest possible freight, namely, Miscellaneous Rates. This reduces the freight to considerably below what it would be in the case of sending cement, steel, timber, roofing, and such items separately to erect a reinforced concrete silo in sections. It is found that in transferring the sections from the trucks to the wagon or cart without the use of the crane, three men can handle them without very great difficulty.

"In addition to this new method of construction, another system of arranging the doors has also been adopted. Steel hinges are put into the concrete and reinforcement taken round same in such a way as to bear the full weight of the doors. Each door, the height of which is 2 feet, is thus hinged, and

can be opened in turn and thrown back against the walls of the silo, as the ensilage is being used. There are tightening bolts for pulling the door hard home against the rabbet in concrete, in which insertion may be placed if so desired by the owner.

"The illustration shown is of a silo erected for Mr. F. Osborne, of Cliffdale, Parkville, near Scone. This silo had been filled at the time of taking of the photo., and had stood the stress of the ensilage. In the filling, Mr. Osborne decided that the crops were rather dry, and he sprayed the same with water. It will be noted that Mr. Osborne has fixed a water pipe permanently in place for such operations, an idea which might be followed out where possible by all owners of silos. It need hardly be pointed out that the introduction of water into dry ensilage increases the pressure on the walls of the silo, but the silo apparently has withstood it.

"One great point in favour of such a silo is that a pastoralist or farmer can erect this with the aid of any handy man on the property. All that is necessary is to put a ring of concrete in level, 12 inches deep by 9 inches wide and about the diameter of the silo that is ordered, and start by bolting the plates together to a circle, so that the inside of the plates coincides with the line that is marked out for it. A peg can be put in the centre of the silo, a batten nailed firmly to the peg, with the hole cored a trifle larger than the nail, and then the batten can be cut off to half the internal diameter of the silo, and by running this round it can easily be seen whether the plates are being bolted circular or not. There is a closing in base about 2 feet 3 inches wide where the doors continue up, as it should be mentioned the doors start 4 feet from the bottom and end 4 feet from the top. If the first row of plates are truly circular and plumb, then the rest must follow suit, and the erection of such a silo be very speedy. If there is no time to put in the foundation for the first year, a clear piece of ground may be levelled and the silo built temporarily upon that. Between each pair of plates there is a groove, which, in the case of the position of the silo being permanently determined upon, is filled with neat cement; one bag of cement will be sufficient to fill all the joints between these plates. There is some patching to be done, when the corners get rubbed or broken.

"There are two forms of roof which may be made for this silo, the one that is shown in the photograph, which is an ordinary octagon roof, lined with ⅝-inch oregon sagging and covered with vulcanite or similar composition; and the patent movable roof, which consists of a cylinder of reinforced concrete 2 feet 6 inches deep placed inside with slight clearance over bottom plates of reinforced concrete girders. This cylinder is watertight, and rises and falls at will, by means of ropes and pulleys and counterbalance weights. When the silo, as in a bad season, cannot be quite filled, then the proper pressure can be given by allowing the full weight of this top to come down on the ensilage. During a rainstorm the rain will collect in this top and add greatly to the pressure, and it may be emptied by means of a syphon passing over the walls of the silo. The slight space between this cylinder and

the walls of the silo can be filled with a composition of vulcanite or similar material, which throws most of the water that should come down the walls into the concrete cylinder itself.

"The cost of this silo, with a fixed roof, works out at about one pound (£1) per ton for any sizes over 100 tons of ensilage that the silo holds. Smaller sizes are slightly increased in cost, as is well known. The price for 100 tons and over is practically one pound (£1) per ton, including freight up to 150 miles, although carting from the station will have to be done by the proprietor to bring it within this price, and he would also have to provide the water for mixing."

The following is an enumeration of the advantages of this type of silo, as claimed by the patentee:—

- It is absolutely permanent.
- Small upkeep.
- The walls non-conductors of heat or cold.
- Continuous hinged doors.
- Ease of erection.
- Comparatively small cost.
- The possibility of building on leased farms by the lessee under agreement with the lessor to remove at end of lease. In this case the grooves would not be filled with cement.
- The possibility of purchasing additional sections to increase the height. The silo could be started at, say, 16 feet, and added to at the will of the proprietor.

Over-feeding of Fowls.

Too generous feeding with over-stimulating food is usually responsible for several ovarian troubles in fowls. The oviduct may become covered with fat and prevent the secretions which form the shell from reaching the egg. The result will be a shell-less, or "soft," egg. Fowls becoming "egg-bound" is due to the same cause. A rupture of a blood-vessel in the ovarium, from over-feeding, will produce clots of blood in eggs.

Remedy:—Give each dozen fowls a 1 oz. packet of Epsom salts in their morning food for two alternate days, and reduce the feeding generally. Maize should be avoided.

Mangels, Mangolds, or Mangel-wurzel.

Beta vulgaris, Linn.

A. H. E. McDONALD, Instructor in Agriculture, Hawkesbury Agricultural College.

THE mangel is well adapted for providing food for pigs, cows, or stud sheep, because of its succulent and palatable nature. On fertile soil, with an abundant rainfall, a greater yield is obtained than from any other crop, but although under such circumstances the roots reach their highest development, profitable crops can be raised on medium soils, and with a comparatively low rainfall. In England it occupies an important position amongst bulk feeds, and large quantities are raised annually for stock of all kinds, but in this State little attention is paid to it except for pig feed, and in isolated cases for dairy cows. This is partly because green crops, such as maize and barley, can take its place, and are easily raised; but, nevertheless, mangels possess certain qualities which make them a desirable addition to our list of crops, especially at certain periods of the year, when green feed is scarce.

The Soil.

Analyses of the roots show that a crop of 22 tons removes from the soil the following quantities of chief plant food ingredients per acre:—

	lb.
Nitrogen	87
Phosphoric acid	36·4
Potash	222·8

These quantities, especially of potash, are larger than those taken away by most other crops, but although so much plant food is required, the crop is not so difficult to grow, even on soils which cannot be called first-class, as the figures would seem to indicate. It is not necessary that the total quantity of plant food required should be in an available form when the seed is sown; indeed, few of even the richest soils, when in constant cultivation, contain so much soluble material at one time. A large proportion of the food substances absorbed by crops becomes available during the time they occupy the land, and since mangels have a long growing season satisfactory yields are possible on land which would not support a quick-maturing crop such as turnips.

The heaviest crops are obtained on rich alluvial soils and deep clay loams of a friable nature. Light loamy soils are suitable, but sandy soils are, as a rule, unsuitable. The root system is extensive, and the soil should be deep, or, where shallow, superimposed upon a fairly open subsoil. Very stiff compact soils prevent the free development of the root owing to the resistance they offer to its expansion.

Climate.

A fair amount of moisture is required by the crop, and, given this, it can be grown in warm districts in either winter or summer. Good crops have been obtained on the Hawkesbury in either season, but a heavier rainfall is required by the summer crop, because of the greater evaporation. A summer crop in 1906 gave a yield of 17½ tons per acre, with 15 inches of rain; while in 1908 a winter crop gave 15 tons, with 11 inches. In cool districts, such as the Tablelands, the best crops are obtained in the summer season, as growth is retarded by the cold weather.

The culture of mangels is likely to be confined chiefly to the Coastal area and Tablelands. On the slopes and plains the rainfall in all but exceptional seasons is too precarious, and this, combined with the dry atmospheric conditions, precludes the hope of its successful cultivation except under irrigation.

Preparation of the Soil.

Thorough cultivation is necessary to bring the soil into the deep friable condition essential to the free expansion of the roots, and to enable the feeding roots to penetrate easily and come in close contact with every part of the soil. If shallow ploughing is given, or the soil left in a rough cloddy condition, root growth is arrested, and the crop prevented from drawing upon the constituents it requires. Large quantities of plant food are required, and the soil must be worked deeply to extend the area which can be exploited by the roots in their search for this food.

Moisture is required in large quantities, both to induce successful germination and in the subsequent growth, and it very frequently happens that the rainfall is insufficient to meet these needs. Recourse must then be made to other means to supply the demands of the crop, and, where irrigation is impracticable, no better method is known than to adopt a system of preparatory culture, by which moisture precipitated during the months preceding sowing can be conserved in the soil to augment the rain which falls during the growing period.

The preparation should commence a few months before the time planned for sowing, especially in those districts subject to dry weather. The soil should be ploughed deeply to increase its capacity for the moisture, warmth, and air which are necessary to those agencies which increase the fertility by bringing insoluble plant food into suitable condition for absorption by the plant. Moisture is particularly essential in this enriching process, and efficient means should be adopted to secure its conservation. If the ground is moist when the first ploughing is given, harrowing should be done at once; but if dry, immediately sufficient rain falls to moisten the clods. This work brings the soil into a fine, firm condition, favourable to the absorption and retention of moisture, and destroys the large open spaces which, by admitting too much air, tend to hasten evaporation. The land should be bare fallowed, and harrowed or cultivated occasionally to destroy weeds and to maintain the loose, open surface which checks loss of moisture.

Immediately before sowing the land should be reploughed, to fit it to receive the seed. A fine, mellow seed bed is required, and, if the soil is in good condition after the fallow, it will only be necessary to give a shallow ploughing. Deep preparation is objectionable immediately before sowing, except under special circumstances, as it destroys the firmness, and in the inversion of the soil buries the rich surface, which has become fertile by weathering, and brings up poorer soil to form the seed bed. This has a prejudicial effect upon young crops, as they must have good soil to encourage their early growth. Soil which is not in good condition after the fallow must be ploughed deeper and thoroughly worked with the harrows to bring it into a favourable state. It must be remembered that a fine, firm, deep seed bed is required, and must be secured, even at the expense of putting the better soil beyond the reach of the young roots. It is preferable to feed the young crop with manures than to have a compact soil beneath a loose surface.

Manuring.

Mangels are exhaustive, and should never be grown on the same land two years in succession, but in a rotation, so that the crop will occupy the same ground not oftener than once in four years. The land should be brought into good condition by applying heavy dressings of farm-yard manure, or, where this is not available, by the growth of some green manure crop. Legumes, such as clover, vetches, or cow-peas, are the most suitable, as they have the power of utilising the free nitrogen of the atmosphere in building up their own tissue, and, when the crop is turned under, this nitrogen is left in the soil in a form in which it can be used by succeeding crops. Deep-rooting, non-leguminous crops, such as rape, do not add anything to the soil from outside sources, but increase the available fertility of the surface by depositing there the plant food drawn from the subsoil. The green manure crop can be utilised by depasturing stock upon it, and ploughing the remains under, or by turning the whole crop in. It is necessary in either case to have the ploughing done a few months before sowing, to allow time for thorough decay. A mass of undecomposed vegetable matter tends to keep the soil in an open, unsatisfactory condition for sowing, and the fermentation produces a certain amount of acidity, which is detrimental to germination and proper growth of plants. When sufficient time is allowed for decomposition, the green crop is reduced to a form in which it has a beneficial effect upon the moisture-holding capacity of the soil, and the acids which form during the process of change are rendered harmless. In addition to the actual amount of plant food left in the surface soil by green manure crops, the large amount of humus added has a favourable effect in making it more friable, easier to work, and more easily penetrated by the roots of plants. It increases the capacity of the soil for retaining moisture, and in a dry climate renders the crop less subject to drought.

The application of manures is necessary on the poorer soils to secure the highest yields, and even on good soils their addition proves beneficial, probably because of the quick, healthy growth they induce in the young crop.

Experiments with artificial fertilisers on a medium loam, in 1908, gave the following results:—

	tons	cwt.	
1.—Unmanured	6	7	per acre.
2.—Superphosphate, 2 cwt. ... Kainit, 4 cwt ... ... Nitrate of soda, 1 cwt. ...	15	2	"

Large quantities of potash are taken from the soil, and the application of manures supplying this is particularly useful to mangels. Phosphoric acid is essential, and its addition in some form generally results in larger yields. It seems to hasten germination and cause a vigorous growth in the young plant. A dressing of nitrogenous manure on poor soils increases the yield, but it is not so important as mineral fertilisers, when judicious cropping and cultivation are practised.

Farmyard manure is extremely useful, because of the plant food it adds to the soil, and its power to increase the moisture-holding capacity. The plant food it contains seems to be in a peculiarly suitable form, and creates a more natural growth than artificial fertilisers. Well-rotted manure is the best, as its plant food is readily available, and it contains no troublesome weed seeds. Fresh manure can be safely and profitably used if applied just after the first ploughing and thoroughly worked into the soil by harrowing. From ten to twelve loads may be applied per acre. Farmyard manure is somewhat deficient in phosphoric acid, and about 1 cwt. of superphosphate should be applied with the seed.

Where farmyard manure is not available, the following quantities of artificial fertilisers can be applied per acre:—

2 cwt. superphosphate.
1 cwt. sulphate of potash.
1 cwt. dried blood.

The sulphate of potash can be satisfactorily replaced by 4 cwt. of kainit, owing to the common salt which it contains being beneficial to mangels.

Sowing.

The best results are obtained when the seed is sown on ridges. The roots must be able to expand freely in growing, and land containing much clay becomes too hard and compact to allow them to do so unless ridged. The ridges should be 2 feet 6 inches to 3 feet apart, and are made by throwing two furrows together with a plough having a fairly long mouldboard. After the ridges have been made, a light roller should be run over them immediately in the direction they run to make the soil firm.

The sowing can be done either in the autumn or spring. In a warm climate autumn sowings give the best crops, while in cool climates the best

yields are obtained from spring sowings. March and April are the best month for autumn sowings, and September and October for those made in spring. The seed is rather shy in germinating, and some care is required to secure a good stand. If possible, cool showery weather should be selected, and under any circumstances the soil must be moist. Sometimes the seed is soaked in warm water for a short time before sowing to start germination, but if the seed is good, and suitable weather selected, this is not necessary. The quantity of seed varies, and depends upon the weather conditions and the amount of moisture in the soil. Under favourable conditions 5 lb. per acre are sufficient, but if there is any doubt of a favourable germination 7 to 8 lb. should be sown. The seed purchased is sometimes defective, and before sowing should be tested by placing a small quantity between damp blotting paper or flannel, and keeping it in a warm room for a few days. What is commonly called the seed is really a fruit containing three to five seeds, and 100 of these should give at least 90 to 100 per cent. of young plants.

Varieties.

The best kinds are Mammoth Long Red and Yellow Globe. On deep, well-worked soils the first gives the best results, while the latter is more suitable for shallow soils.

Cultivation.

Under favourable conditions, the young plants appear in about nine days, but, if the soil is dry, the seed may remain in the ground several weeks before germinating. Weeds must be kept down by hoeing and cultivation, but the ridges should not be destroyed in the working. As the roots take firmer hold of the ground, the cultivator can be worked up closer to them, but care must be taken that the roots are not injured, as this causes bleeding and decay. This cultivation is very important, as upon its proper performance depends very largely the amount of plant food and moisture which will be available to meet the wants of the growing crop. Loosening of the surface checks the loss of moisture and facilitates the aëration of the soil, and thereby encourages the activity of those agencies which increase the stores of available plant food.

Harvesting.

The crop takes between seven to eight months to reach maturity, which is indicated by the cessation of growth and the leaves losing their healthy green colour, and becoming yellowish and mottled. Harvesting should be delayed until maturity is reached to secure the highest yield and best quality, but in hot districts it must not be left later, as the plants commence to produce seed and the roots deteriorate in value. Immature mangels can be fed in small quantities to pigs, but not to cows, as they impart a bad taint to milk, and are likely to cause scouring. No bad effects follow the feeding of mature roots.

The mangels should be carefully pulled, the adhering soil shaken off, and the roots trimmed by cutting or twisting the tops off just above the crown. Roots which are to be stored must not be injured in handling, as bruises provide a vulnerable point for the attack of disease.

Storing.

In a warm climate the successful storage of roots is usually difficult, owing to the temperature being favourable to the development of the agencies which cause decay. If, however, mangels are carefully handled they can be stored for some time, especially in the cool winter months. The best method of storing is to place the mangels on a bed of straw, in a well-ventilated shed, in stacks about 2 feet deep. Where sheds are not available they can be kept fairly well by stacking on dry straw on a well-drained piece of land in the open.

Feeding Value.

Mangels are the most watery of all roots, but, because of the large yields, the actual amount of food produced per acre compares well with any other.

The following results of experiments, taken from Henry's "Feeds and Feeding," show the comparative value of mangels and grain as feed for pigs:—

Average daily gain of pigs fed on grain and mangels.

	10 lb. roots=1 lb. grain.	8 lb. roots=1 lb. grain.
Lots A, B, C, D	Grain, ·76 lb.; roots, ·83 lb.	Grain, ·85 lb.; roots, ·86 lb.

The figures show that 10 lb. of roots are more than equal, and that 8 lb. are about equal to 1 lb. of grain.

Since an average crop of maize returns about 2,240 lb. of grain, while an average crop of mangels equals 20 tons, or 44,800 lb., it can be seen from these results that 1 acre of roots produces as much pig feed as 2½ acres of maize.

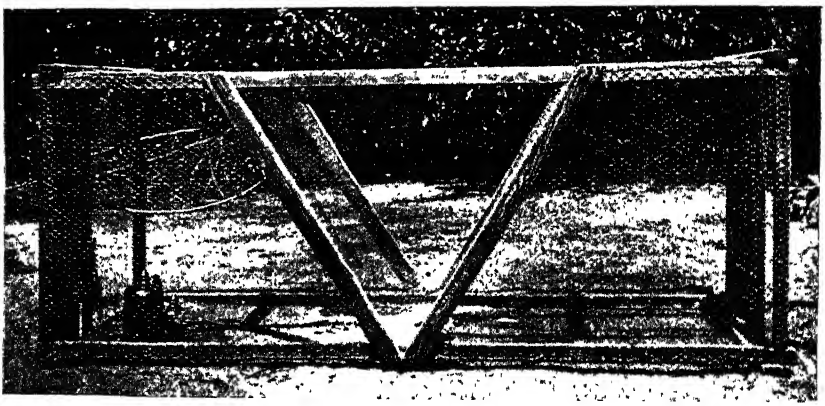
In "Dairying in all its Branches," Mr. O'Callaghan writes: "Of the various root crops, mangels are the most valuable to the dairy farmer; they do not taint milk like turnips, and, if properly stored, will keep well, and come in at a time when other feeds are scarce, viz., the beginning of spring. Mangels are noted for stimulating a heavy flow of milk, and in this they are somewhat like brewer's grains. When fed largely, that is, more than 21 lb. a day per head, cows will fall off in condition unless some more concentrated foods are supplied."

Mangels sown early in autumn mature about October, and help to provide suitable food for pigs and cows at that time, when other feed is scarce, and add variety to the feeds. The roots can be fed either cooked or uncooked, but, except where cooking appliances are already at hand, the added value would not justify much expense in this regard. Where the necessary machinery is installed, it is advantageous to pulp the roots, but they can be satisfactorily fed either whole or roughly chopped.

A Good Sparrow Trap.

The trap shown in the accompanying illustration has been in use at the Hawkesbury Agricultural College for two years. In twelve months over 1,000 birds were caught, often at the rate of twenty or thirty a day.

The sparrows enter by way of three small holes, 2 inches in diameter, in the bottom of the V shaped centre, and just 3 inches above the wire-netting floor. This latter is thinly covered under the holes with soil on which a little food (wheat, bread crumbs, &c.) is sprinkled. The netting is 1 inch mesh. Once a few birds are caught, or several are put in, sparrows are attracted and caught freely. The frame is 8 feet long, 3 feet high and 3 feet broad. There are doors occupying half the width at each end. The trap was originally fitted with a funnel-shaped exit ending in a bag, the extreme end of which was tied with string. Into this bag the birds were driven for easy catching, but it is not now used.



Sparrow Trap used at Hawkesbury Agricultural College.
Made by Mr. W. Marcom, Greek-street, Bathurst.

Alleged Adulteration of Bran, Pollard, &c.

The attention of the Department of Agriculture has been drawn to the possibility of a substance known as "Buffain"—a meal made from ground husks or rice hulls—being imported from Java or Rangoon and used for the adulteration of bran, pollard, etc. Some years ago, it is stated, a substance answering the description was imported; but the Collector of Customs has issued instructions to the Customs Officers in this State with a view to the detection of any such importation at the present time.

List of Fertilisers in New South Wales

F. B. GUTHRIE AND L COHEN.

1910 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition, as guaranteed by the vendors, and their values, is the result of the revision of the list issued in April, 1909.

The list is published in the interest of the farmers, and it is hoped that it may serve as a guide to those requiring any particular class of manure.

It must be clearly understood that the figures given are not those obtained by analysis of the sample by the Department. They represent the guarantees given by the vendors in accordance with the provisions of the Act.

Where possible, samples have been taken from bulk by one of the officers of the Department, and only those manures are inserted in the list which have been found on analysis to be up to the guarantee.

A word is necessary in explanation of the column giving the "values" of the manures. These figures are calculated from the composition of the manures as represented by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values here given are computed are as follow :—

UNIT-VALUES of fertilising ingredients in different manures for 1910.

	Per unit. s.	d.
Nitrogen in nitrates	18	10
,, in ammonium salts	12	9
,, in blood, bones, offal, &c.—fine	15	0
Phosphoric acid in bones, offal, &c.—fine	3	0
Potash in sulphate of potash	5	2
Potash in muriate of potash	4	8
Phosphoric acid in superphosphate and mineral phosphate—		
Water-soluble	5	2
Insoluble	2	9

PRICE per lb. of fertilising ingredients in different manures for 1910.

	Pence per lb.
Nitrogen in nitrates	10·1
,, in ammonium salts	6·8
,, in blood, bones, offal, &c.—fine	8·0
Phosphoric acid in bones, offal, &c.—fine	1·6
Potash in sulphate of potash	2·8
Potash in muriate of potash	2·5
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble	2·8
Insoluble	1·5

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result

being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid :—

4 x 15s. 0d.	= £3 0s 0d.	= value of the nitrogen per ton.
20 x 3s. 0d.	= £3 0s. 0d.	= value of the phosphoric acid per ton
	£6 0s. 0d.	= value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions; neither does it represent the costs incurred by the manufacturer in the preparation, such as cost of mixing, bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail price of the manure, and the fact that in the majority of cases the price asked and the value assigned are fairly close shows that the valuation is a reasonable one.

These figures have been checked in all cases by analyses made on samples collected by an officer of the Department. It by no means follows, however, that the particular product analysed and here published will be in stock for any length of time.

Some agents guarantee two figures—for instance, "from 16 to 18 per cent. phosphoric acid." In these cases the lower one has been published in the list, as it will certainly be the one the vendors will rely upon in cases of dispute.

Now that the Fertiliser Adulteration Act is in force, the purchaser has only himself to blame if he pays for an inferior article. Every vendor is obliged to furnish a guarantee with every delivery of fertiliser, setting forth its actual composition as determined by analysis.

If the purchaser has any reason to suspect the genuineness of the guarantee, all he has to do is to notify the vendor of his intention to take samples for analysis, in sufficient time to enable the vendor or some person appointed by him to be present. The samples must be taken before the consignment is finally in the purchaser's possession; for example, if the fertiliser is sent by rail, the sample should be taken at the railway station or siding. Three samples must be taken, one being given to the vendor or his representative, the second kept by the purchaser and submitted to an analyst, and the third forwarded to the Department of Agriculture for future reference, in case of divergence in the analyses of the other two. All three samples must be sealed up.

In the case of bone-dust, blood, and bone manures, &c., the valuation has been made irrespective of the fineness of division, and is based on the amounts of fertilising ingredients only; but it must be borne in mind that finely ground bone-dust acts more rapidly than coarse, and that unground fragments of bone only become available as fertilisers very slowly.

A word may be added in explanation of the term water-soluble phosphoric acid. When bones or mineral phosphates are acted on by sulphuric acid, a

portion of the tricalcic phosphate is converted into another lime compound, known as monocalcic phosphate or superphosphate. This compound is soluble in water, and it is to its presence that the rapid action of the phosphate is due. This is the "water-soluble" acid of the table. In many superphosphates, however, a considerable portion of this compound has undergone change. This change may be due to the salts of iron and alumina present, or to the length of time it has been kept, and it results in the formation of a third lime compound—bi-calcic phosphate. This is known as "reverted" or "retrograde" phosphoric acid, and is insoluble in water, but soluble in ammonium citrate.

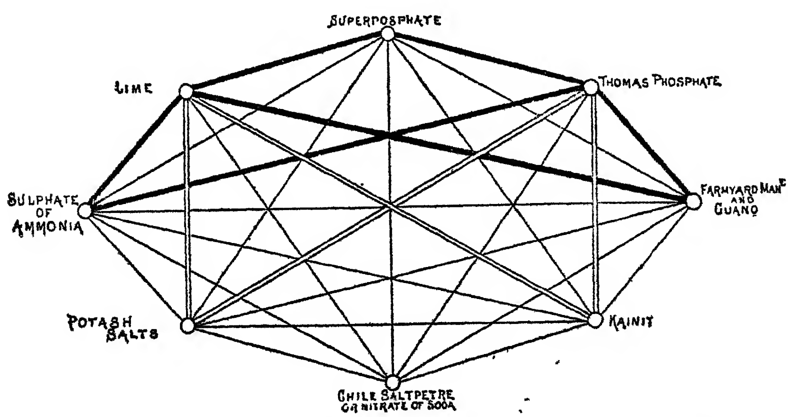
In the fourth table are a number of waste products which may in many cases be economically utilised.

WHEN purchasing a manure always insist on a guarantee of its composition as determined by analysis.

Artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases loss of nitrogen results; and when lime has been applied to the land do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures. The diagram originates with Dr. Geekens, Alzey, Germany, and is taken from an article by Mr. Leo. Buring in the *Garden and Field* of 10th October, 1903.



Substances connected by thick line must not be mixed together.
Substances connected by double line must only be mixed immediately before use.
Substances connected by single thin lines may be mixed together at any time.

I.—Simple Fertilisers.

Manure.	Where obtainable.	Guaranteed Composition. Nitrogen.	Equivalent to Ammonia.	Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Manurial Value. £ s. d.
Sulphate of Ammonia...	Australian Gaslight Co., Kent-street, and any manure merchant.	20·40	24·77	... .	.. ..	.. .	13 0 0
Nitrate of Soda...	Gibbs, Bright, & Co., 37, Pitt-street, and any manure merchant.	15 90	19·30	. ...	.. ..	.. .	15 0 0
Kainit	Potash Syndicate, and any manure merchant ..	... ..	.	......	12·5	......	3 4 7
Muriate of Potash	,, ,, ..	......	.. ..	......	60·0	.....	14 0 0
Sulphate of Potash	,, ,, ...	......	.... .	... .	52·0	......	13 10 0
30 % Potash Manure	,, ,, ...	.. ...	.....	......	30 0	.....	7 0 0
Thomas' Phosphate	Paton, Burns, & Co., corner of King and Sussex streets.	. ..	... ..	......	... ..	18 0	......
Sulphate of Potash	A. H. Hasell, 2, Bridge-street	. ..	...	......	51·3	.. ..	13 5 0
Building Lime*...	Sydney and North Sydney Lime and Cement Co., 17, Pitt-street.	... ..	. ...	95·0 (about).	.....	......	... .
Gypsum Fertiliser*	A. H. Hasell, 2, Bridge-street	......	. ...	98·0 Cryst. $CaSO_4$.	......	......	... ..

* Lime and Gypsum not guaranteed.

II.—Bone and Blood Manures.

Manure	Where obtainable.	Guaranteed Composition. Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.	Equivalent to Tricalcic Phosphate.	Manurial Value. £ s. d.
Special fertiliser, No. 3	Co-operative Wholesale Society, Alexandria	5·0	6·07	18 3	40·0	6 9 11
Bone and blood, B.B.	Waratah Fertiliser Co., Ida-street, Waratah	4·8	5·83	21·7	47·4	6 17 1
Bone-dust	,, ,, ,, ,,	4·12	5·0	22 9	50·0	6 10 6
Dried blood	Colonial Fertilisers Co., 117, Pitt-street	10 7	13·0	....	....	8 0 0
Fish manure	,, ,, ,,	6 18	7·5	11·45	25·0	6 6 0
Bone-dust, No. 1	Paton, Burns, & Co., corner of Sussex and King Streets.	3·91	4·75	23 82	52·0	6 10 1
,, No. 2	,, ,, ,, ,,	3·91	4·75	23·82	52·0	6 10 1
Bone and blood, B.B.	,, ,, ,, ,,	5 35	6·5	11·91	26·0	5 16 0
Blood	,, ,, ,, ,,	10·7	13·0	....	....	8 0 6
Offal manure	,, ,, ,, ,,	6 82	8 0	....	....	5 2 4
Bone and blood manure	R. S. Lamb & Co., 55, Pitt-street	5·76	7·0	13·74	30·0	6 7 7
A 1 bone-dust	,, ,, ,,	4·12	5·0	18·78	41 0	5 18 2
*** bone-dust	,, ,, ,,	3·91	4 75	23 82	52·0	6 10 1
Vulture manure	,, ,, ,,	4·0	4·85	18·32	40·0	5 14 11
Raw or green bone-dust	A. Wooster, Epping	4·01	4·86	24·41	53·3	6 13 5
Blood and bone-dust	,, ,,	5·76	7·0	13·74	30·0	6 7 2
Pure steamed bone-dust	,, ,,	3·91	4·75	24·50	53·5	6 12 2
Blood	,, ,,	13 17	16·0	....	....	9 17 6
Blood and bone manure	A. H. Hasell, 2, Bridge-street	5·5	6·68	18·0	39·29	6 16 6
Blood	,, ,,	12·36	15·0	....	....	9 5 5
Bone-dust	,, ,,	3·75	4·55	22·5	49 1	6 3 9
Bone and blood manure	G. W. Eaton, Enfield	6·74	8·18	15·93	34 77	7 8 10

III.—Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manure.	Where obtainable.	Guaranteed Composition.				Manurial Value.
		Nitrogen.	Water soluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.	£ s. d.
Superphosphate, 36–38 per cent.	George Shirley, Limited, 279, George-street...	......	17·0	.. ...	......	4 17 10
A 1 Superphosphate ...	,, ,, ...	......	18·3	......	......	4 14 6
No. 1 Superphosphate ...	A. H. Hasell, 2, Bridge-street	......	17·5	18·5	......	4 13 2
A 1 Superphosphate ..	,, ,, ...	......	19·0	19·75	......	5 0 3
Nitro-superphosphate ...	,, ,, ...	1·35	15·44	19·05	......	5 8 2
Bone and superphosphate..	,, ,, ...	1·5	9·0	20·5	......	5 0 7
Guano	Paton, Burns, & Co., corner of King and Sussex streets...	.....	......	25·9	......	3 11 3
Superphosphate	,, ,, ,, ..	......	17·0	......	......	4 7 10
No. 6. Potato Fertiliser ...	A. Wooster, Epping	4·52*	......	14·19	5·0	6 14 6
No. 7. Complete Fertiliser.	,, ,, ...	5·01†	......	14·56	2·0	6 6 5

* ·75 Ammoniacal. † 1·20 Ammoniacal.

IV.—Waste-Products, Ashes, &c., not on the Market.

Manure.	Original Source	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble	Lime.	Phosphoric Acid.	Potash.	Manurial Value. £ s. d.
Deposit from wool-scouring tanks. 1	Liverpool Wool-scouring Works.	.....	....	·64	·78	...	.....	....	·72	0 12 6
2	„ „ „	....	....	1·02	1·24	...	...	·16	·39	0 16 5
3	„ „ „	....	....	1·37	1 66	...	...	·14	·20	1 0 2
Deposit from breakers	„ „ „	34·47		1·81	2 20	50·68	·85	·88	1·60	1 15 0
Sediment from wool-scouring works.	Yass	19·57		·59	·71	78·24	·97	...	·20	0 9 10
Scutch	Australian Glue-Gelatin Works, Alexandria.	56·98	....	2 95	3·58	....	4·56	None.	None	2 4 3
„ from limed pelts	Hugh Wright, Auburn	5·32	73·42	1·80	2 18	3·61	9·36	·89	·20	1 8 2
Decomposed hair and lime	Fellmongery	9·70	57·08	6·86	8 33	1 22	26 27	....	..	4 13 9
Tan-yard refuse	Tanneries, St. Mary's	6·43	33 83	2·24	2 72	21·43	26·96	·67		1 19 5
Tan refuse	....	7·10	50·90	2 62	3·18	16·03	18·58	·56	·18	2 1 11
Fleshings from tannery	....	4·91	75·37	4·43	5·38	5·98	.....	1 14	·04	3 9 10
Salt (sweepings from tannery)	....	3·04	....	·70	·85	·38	.....	.	..	0 10 6
Wool-waste	....	....	....	8·15	9·89	.	...		.	6 2 3
„	....	34·33	28·20	1·97	2·39	26·03	2·75	·37	·32	1 10 8
Peat	H. Tager, Moss Vale	72·93	16 68	·35	·42	10·39 (ash).	...	..	....	0 5 3
„	S. Cook, Pyrmont	49 51	34·63	·75	·91	......	.....	·06	·01	0 11 3
Burnt peat	....	......	....	......	....	84·45	.....	·25	·33	0 2 6
Filter-press muck	Cane-mills, Broadwater	16·39	26·07	·22	·27	34·86	13 20	5 98	·44	1 3 6
Megass	Clarence River cane	22·86	67·32	·63	·78	8·61	·30	·01	·05	0 9 5
Megass ash	„ „	......	....	....	..	87·69	3 07	·16	·51	0 3 0
„	Richmond River cane	......	....	....	..	.....	1 11	21	4 79	1 5 6
Bloodwood ash	....	......	....	....	......	....	8·47	27	5·25	1 7 10
Ironbark ash	....	......	....	....	....	.....	.....	·82	1·53	0 10 3
Blackbutt ash	....	......	....	....	....	....	7·27	·04	2 02	0 10 7
Red-gum ash	....	......	....	.....	....	.....	......	·38	4·17	1 2 7
Spotted-gum ash	....	......	....	......	......	....	....	·10	·70	0 3 11
Boxwood ash	....	....	....	......	......	......	....	·67	1 65	0 10 5
Grass-tree ash	....	·86	1·78	....	....	33·48	24 94	3 07	5 30	1 16 1
Vine-cuttings ash	....	·49	....	....	....	60 64	11·34	1·85	3·76	1 4 8
Red-apple ash	....	....	....	......	......	54·52	13·96	·47	6 00	1 12 4
She-oak ash	....	......	......	....	......	8·57	42·35	8·85	2·19	1 16 5
Hardwood ash	....	·50	1·35	....	.....	62·38	13·50	1·76	3·09	1 1 3
Ash of wild melon	Stock Branch	.....	....	....	....	......	5·12	4·85	27·08	7 14 5
Wood ashes	....	·30	....	....	....	21·43	41·37	·35	2·80	0 15 6
„	Wentworth Irrigation Area	....	....	....	....	11·12	50·78	·53	3·21	0 18 8
Ash of kerosene shale	Hartley Vale	1·49	27·93	·70	·85	67·59	....	·28	·14	0 11 1

IV.—Waste-Products, Ashes, &c., not on the Market—*continued*.

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Manurial Value. £ s. d
Clinker from locomotive boiler	...	...	...	...	...	...	...	...	·25	0 1 4
Residue from furnace	R. E. Bragg, Marrickville	1·55	35·63	·54	·61	52·40	·64	·43	09	0 9 4
Sea-weed ash	...	...	...	...	...	...	9·27	·49	·59	0 4 7
,,	...	...	...	...	...	...	6·29	1·27	17·55	4 14 6
,,	...	·43	...	...	...	56·28	9·39	·47	2·26	0 13 1
,,	Manly	...	...	...	...	43·06	6·52	·91	13·98	3 15 0
,,	,,	...	...	...	...	·07	·53	·19	34·30	8 17 9
,,	Mr. Harvey, Department	3·25	19·46	...	...	61·63	4·22	·33	·22	0 2 1
Sea-weed, fresh state	...	80 00	...	·16	·19	...	·41	·09	1·18	0 8 6
Sea-weed	...	41·03	42·49	·14	·17	...	...	·21	·60	0 5 10
Sea-weed, dried	...	18·58	65·97	1·64	1·99	15·44 (ash).	3·44	·14	·14	1 5 9
Air-slacked lime	...	16·58	...	...	...	1·88	75·44	...	...	...
Residue from calcium carbide	...	41·36	...	...	...	1·08	36·19	...	...	...
Limestone rock	Queanbeyan	1·10	...	...	...	4·70	48·20	1·22	...	0 3 4
Agricultural lime	Portland Cement Co.	18·43	...	...	...	23·80	Hydrate 13·80 Carbonate 43·97	...	...	...
Gypsum	Marulan		(Crystallised	$CaSO_4$=92 64		4·47	...	...	...	...
Cave deposit, shells, &c.	Cowan, Hawkesbury River	2·11	...	·82	1·00	...	35·40	1·59	·88	1 1 7
,, ,,	Macleay River	23·06	16·01	2 43	2·95	26·77	13·88	7·40	...	2 18 8
Deposit (coral, shell, &c.)	Pacific Islands	2·13	13·53	·72	·87	...	44·00	3 53	·39	1 3 6
Shells	Pambula River	...	...	...	...	...	44·59	·10	...	...
Flue deposit	Maitland	...	...	...	...	83·75	2·56	·32	·31	0 2 6
,,	Liverpool	...	...	...	...	91·17	·42	1·29	·17	0 4 8
,, from sanitary furnace	...	...	...	...	...	63·53	6·64	1·82	1·61	0 13 9
,,	...	6·30	2·15	...	...	84·89	·32	·35	·33	0 2 0
Night-soil mixed with lime	...	44·33		·74	·89	18·60	27·62	·78	...	0 13 5
Night-soil	Wagga Wagga	6·70		·03	·04	82·19	·44	·28	·69	0 4 9
,,	,,	9·14		·28	·34	78·92	1·18	·18	54	0 7 6
,,	,,	...		·50	·61	...	...	·64	·62	0 12 7
Night-soil preparation, No. 1	...	8·22		3·73	4·63	50·22	13·32	9·65	91	5 0 1
,, ,, No. 2	...	7·20		1·83	2·22	29 02	6·05	4·10	·15	2 7 1
,, ,, No. 3	...	25·95		1·64	1·99	60·17	1·39	1·61	·70	1 12 11
,, preparation, "Pinhoe" manure.	...	·92	9 54	·21	·25	57·58	14·71	1·26	·56	0 9 7
Night-soil preparation	F. Artlett, Parramatta	7·33	30·06	2·10	2·55	46·38	2·09	1·92	·61	2 0 5
,, ,,	,,	10·11	42·59	4·97	6·03	·94	30 12	·39	...	3 15 9
,, ,,	Mr. Halstead, O'Brien's patent.	1·54	12·36	·54	65	77·95	...	·63	...	0 10 0
,, ,,	...	29·52	56·15	2·55	3·10	14·33 (ash).	...	...	...	1 18 3

IV.—Waste-Products, Ashes, &c., not on the Market—*continued.*

Manure.	Original Source.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble	Lime.	Phosphoric Acid.	Potash	Manurial Value.
										£ s. d.
Farmyard manure	...	67·96	22·09	·40	·49	8 16	·16	20	30	0 8 1
Stable manure	Bathurst	39·26	...	·41	·50	...	...	·27	67	0 10 5
Fowl manure	...	3·95	16·48	1·47	1·78	70·16	2·10	1·94	...	1 7 10
"	...	1·54	15·23	·86	1·04	79·96	64	·59	33	0 16 5
Sheep manure	Bathurst	7·73	...	1·06	1·30	...	...	·69	1 17	1 4 0
"	Liverpool Wool-scouring Works.	9·71	50·91	1·79	2·17	32·26	2·00	·91	·92	1 14 4
Sheep dag	...	...	...	3·04	3·69	...	...	...	...	2 5 7
Refuse manure	Abattoirs	12·00	74·51	4·14	5·03	6 56	...	1·80	...	3 7 6
Flying-fox manure	...	1·09	35·34	3·34	4·05	50·29	1·02	·36	1·15	2 17 1
Fish fertiliser	...	14·47	64·36	10·37	12·59	4·52	...	...	...	7 15 6
Shark fertiliser	...	9·02	68·04	10·59	12 85	3 86	...	7·27	...	9 0 8
Fish manure	...	10·88	59·26	6·10	7·40	5·39	9·82	8·28	...	2 17 1
Rabbit hair, long	Anderson, Oxford-street	8·73	88·64	14·03	17·04	3·63 (ash).	...	...	...	10 10 5
" short	" "	9·72	87·76	14·00	17·00	2 82 (ash).	...	...	...	10 10 0
Bat-guano	...	14·11	17·69	1 55	1·88	28·77	13·72	11·42	...	2 17 6
"	...	10·86	19·65	2·24	2·72	51·95	1·75	3·55	·15	2 13 7
"	...	13·70	34·35	4·76	5·78	3·30	22·28	13·04	trace.	5 0 6
Bat deposit	Cave Flat, Cooradigbee	5·43	12 98	·50	·61	57·64	5·60	12·12	...	2 3 10
Guano deposit	Tamworth	8·75	38·40	6·17	7·49	12·85	...	9·24	...	6 0 3
" "	"	8·42	20·97	3·10	3·76	31·89	...	7·87	...	3 10 1
" "	"	14·55	29·91	3·66	4·44	15·81	...	12·98	...	4 13 10
" "	"	9·35	44·32	6 73	8·17	7·33	...	13·17	...	7 0 5
Bone breccia	Queanbeyan	5·71	...	·59	·72	9·48	42·80	3·11	...	0 18 2
Muck from waterworks reservoir	Maitland	4·84	17 55	·74	·90	63·42	4·56	31	·60	0 15 1
Muck raked from waterhole	...	63 66	29·86	·81	·98	3·80	·96	·10	·06	0 12 9
Sawdust	...	32·52	62·35	·82	1·00	...	...	1·70	·05	9 17 6
Decayed wood, bark and leaves, bloodwood.	...	57·80		·74	·89	40·68	1·30	...	...	0 11 1
Decayed wood, bark and leaves, pepper-tree.	...	79·92		·89	1·03	17 77	1·50	...	...	0 13 4
Coco-nut oil cake	...	8·24	...	3·29	3·99	...	...	1·20	1·49	3 0 7
Castor cake	...	18·81	74·08	4·30	5·22	...	...	1·83	·86	3 14 5
Pea cake	Java	16·02	...	7·24	8·79	...	...	1·46	1·17	5 19 0
Bean cake	North China	14·52	80·32	6·77	8·22	...	...	1·33	1·09	5 15 9
Rice husks	...	42·74	42·15	1·07	1·30	13·77	·02	·03	·04	0 16 4
Field pea, whole plant	...	88·58	9·97	·55	67	...	·15	12	·49	0 11 2
Tares, whole plant	...	83·97	14·96	·73	·88	...	...	·11	·21	0 12 5
Marsh mallow, whole plant	...	79·00	17·86	·85	1·03	...	...	·14	·69	0 16 9
Horse bean, leaves and stalks	...	82 87	15·90	·90	1·09	...	·05	11	·54	0 16 7

Worm Infestation in Lambs

Report on a Series of Experiments for Prevention and Treatment.

MAX HENRY, M.R.C.V.S., Government Veterinary Surgeon, and R. H. GENNYS, Manager, Glen Innes Experiment Farm.

In the *Agricultural Gazette* for December, 1908, there were published the results of a series of experiments in connection with the treatment of sheep suffering from infestation by various species of parasitic worms. As these results were, though interesting, mainly of a negative character, it was decided to carry out last year a series of combined prevention and treatment experiments in order to demonstrate the practicability and efficiency of varying methods. Only such methods as might be utilised by the farmer and stockman were undertaken, more especially such as might be useful to the small sheep farmer. The experiments were carried out at the Glen Innes Experiment Farm with lambs bred on the farm. These lambs, which at the commencement of the experiment averaged six weeks old, were divided into four lots, and treated as follows :—

Lot No. 1.—Six ewes and lambs were placed on improved pastures of lucerne and introduced grasses, and were left untreated other than being allowed ordinary rock salt in troughs.

The feed for these lambs consisted of lucerne, red clover, prairie grass, Kentucky blue grass, Timothy, perennial rye grass, Italian rye grass, cocksfoot.

Lot 2.—Twenty ewes and lambs were placed in a paddock whence infested sheep had been taken the previous year, and were drenched six times, at intervals of one month, with an arsenic drench, and were allowed rock salt. Six ewes and lambs were placed in this paddock to act as controls. The feed in this paddock was fair all the season, but the paddock was heavily stocked. It contained much green timber, and had been used for sheep every year. The water supply was obtained from an old gravel pit and some tanks.

Lot 3.—Seventeen ewes and lambs were placed under natural conditions in an infested paddock in which sheep had been kept the previous year, and were provided alternately with two licks, one of Liverpool salt 10 lb., bone meal 5 lb., and sulphate of iron $\frac{1}{4}$ lb.; the other the same, save that calcium phosphate was substituted for bone meal. Seven ewes and lambs were placed in this paddock also, but they, in addition, were drenched with arsenic three times during the year. The water supply was a tank, the same as that used by Lot 4.

Lot 4.—Six ewes and lambs were placed under natural conditions in a paddock which had been kept free from sheep for three years, although cattle had been grazing on it, and were allowed rock salt. The feed in this paddock was good all the year round. The water supply was the same as

that of Lot 3, and was obtained from a dam. This paddock was understocked, and the sheep therein had some opportunity of feeding upon oaten straw thrown down for the cattle in the paddock. This must be considered in reviewing the results.

General health and condition throughout the experiments.

At the commencement, during January and February, the lambs looked well, although some of the ewes showed obvious signs of parasitic infestation. As the autumn progressed, some of the lambs became poor, and there was some œdema between the jaws. During April there was a marked recovery, but from then onwards they fell off in condition and appearance until about the middle of August, after which there was rapid and sustained improvement. Only two lambs were unaccounted for at the end of the experiment, and the cause of death is unknown, but in all probability it was due partly to weakness from worm infestation Amongst the flock lambs there were several deaths during the year, due to the presence of worms, and *post-mortem* examination of three of these revealed serious infestation both with *Strongylus filaria* and *Strongylus contortus.*

On the whole, it would seem that worm infestation this year was hardly so serious as last year, although several properties in the neighbourhood of the Experiment Farm reported very heavy visitations.

Results of Post-mortem Examinations.

Lot.	Date.	*Strongylus filaria*—Lung Worm.	*Strongylus contortus*—Stomach Worm.	*Trichocephalus affinis*—Intestinal.	*Œsophagostoma columbianum*—causing Pimply Gut.	*Taenia alba*—Tape Worm.
P.Ms. to determine infestation.	9 Jan.	......	A few found	......	......	A few found.
Lot 1—Fed on introduced grasses.	14 Feb	......	Very numerous	......	Few	Few.
	12 Mar.	......	"	......	......	......
	23 April	Very few	Very few	......	......	......
	24 Sept.	......	......	......	Few	......
Lot 2—Drenched monthly	14 Feb.	......	Numerous	Few	......	Numerous.
	12 Mar.	......	Very few	......	......	......
	23 April	......	Few	......	......	......
	25 June	......	Very few	......	Few	Few.
	24 Sept	Very few	......	......	"	......
Controls	14 Feb.	......	Numerous	......	......	Numerous.
	12 Mar.	......	Few	......	Few	"
	23 April	Very few	"	......	"	......
	23 Sept.	"	Very few	......	......	......
Lot 3—Supplied with licks	14 Feb.	......	Numerous	......	......	Few.
	12 Mar.	......	Fairly numerous.	......	Few	......
	23 April	......	Very numerous	......	"	......
	25 June	Few	Few	......	......	......
	24 Sept.	......	Very few	......	Few	......
Supplied with lick and drenched three times	14 Feb.	......	Few	......	"	Numerous.
	12 Mar.	......	Very few	......	......	Very few.
	23 April	Very few	Few	Very few	Very few	Numerous.
	25 June	"	......	......	Few	......
	24 Sept.	"	......	......	"	......
Lot 4—Controls	14 Feb.	"	Numerous	......	"	......
	12 Mar.	......	Fairly numerous.	......	......	Very numerous.
	23 April	......	Few	Numerous	Few	Numerous.
	24 Sept.	Very few	Very few	......	"	......
Flock lambs	24 "	(1) Fairly numerous.	"	......	"	......
Drenched once	24 "	(2) Numerous.	Numerous	......	"	Few.

These examinations were carried out at intervals during the experiment, as a rule one lamb from each lot being examined. The results, so far as worm infestation is concerned, are given above.

Analysis of these examinations fails to reveal any very remarkable results as regards treatment, but they raise several points of interest. It would appear that *Strongylus filaria* is unlikely to cause any trouble before the late autumn, but from thence on to October, infestation becomes worse. *Strongylus contortus* attacks lambs at an earlier age, and is probably conducive of far more mortality amongst lambs than the *Strongylus filaria*, judging from these *post mortems* and observations on these series of experiments. Early autumn appears to be the time at which these parasites are most numerous, though they may be found in large numbers up to early spring, especially in lambs weakened by early privations. During these experiments they ceased to be found in any large numbers as the spring advanced, both in drenched and undrenched sheep, and this decrease is due to natural causes, and must not be regarded as condemnatory of drenching, as is explained below. The *Trichocephalus affinis* and *Œsophagostoma columbianum* cannot be regarded as a serious cause of trouble in young sheep. Lastly, the tape worm *Monezia* (*Taenia*) *alba* is seen to infest lambs at a very early age, and judging from the size and number of the specimens found, is likely to be accountable for much loss. However, it disappeared completely as the autumn advanced, and after that time was practically negligible.

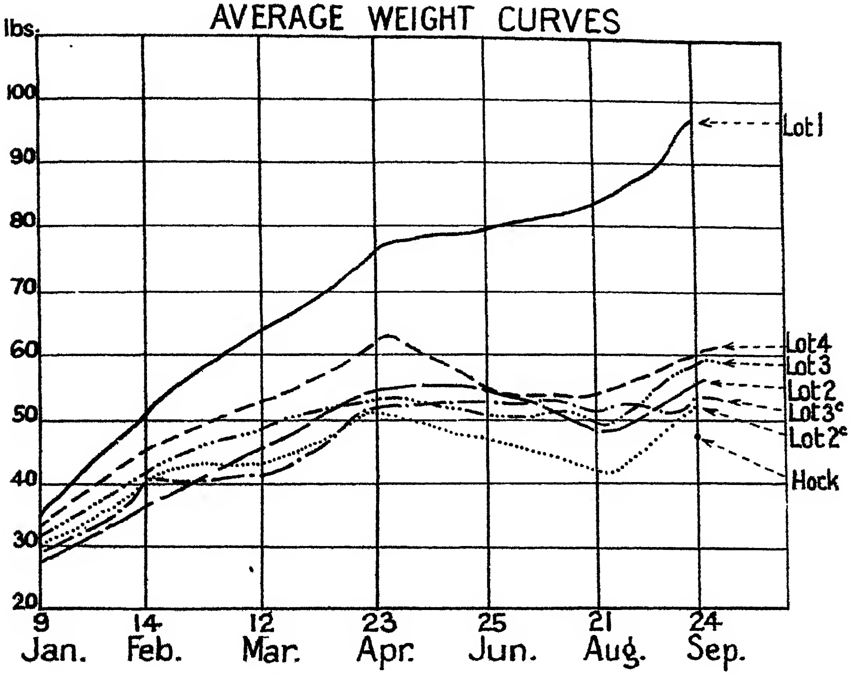
This marked periodicity of worm infestation probably accounts for many of the remarkable instances of cures recorded in all good faith by users of various remedies. The drench used was an arsenical one, viz. :—

For lambs under 3 months.	Over 3 months.	Over 6 months.	Over 9 months.
Arsenic, ½ grain.	Arsenic, 1 grain.	Arsenic, 1½ grains.	Arsenic, 2 grains.
Sod. Carb., 1 grain.	Sod. Carb., 2 grains.	Sod. Carb., 3 grains.	Sod. Carb., 4 grains.
Water up to 1 oz.	Water up to 1 oz.	Water up to 1 oz.	Water up to 1 oz.

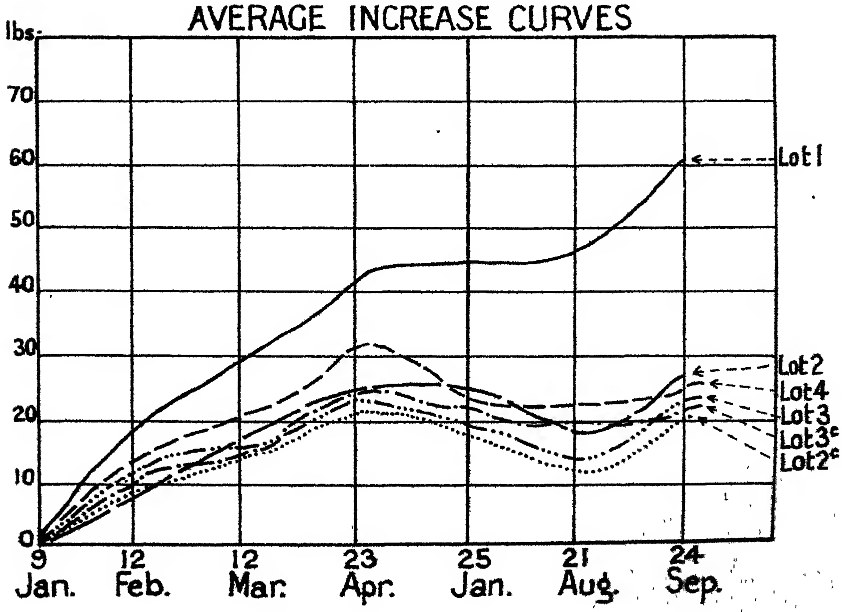
In order to demonstrate the efficacy of this drench, the following experiment was carried out:—Two lambs were placed in a pen and starved for sixteen hours; they were then dosed with the drench, the pens cleaned out, and twenty-four hours later the excreta were collected and examined. In the excreta passed before drenching an odd worm was found here and there, but in that examined after drenching, in 1 oz. of fæces chosen at random, were found 59 nematodes (small stomach and intestinal worm) and one cestode (tape worm). In this way undoubted proof of the efficacy of the arsenic drench as regards stomach and intestinal worms was obtained, providing it be properly and carefully administered. This series of experiments confirms the opinion expressed after the series of last year, that drenching is practically useless for the treatment of "lung worm."

The method of drenching is a matter to which sufficient importance is hardly given. Great care should be taken in preparing arsenic drenches that all the arsenic and soda are dissolved, and the fluid should then be filtered through cloth to remove any large particles, or the sediment allowed to settle and only clear fluid used. The best method of administering a drench is to

AVERAGE WEIGHT CURVES



AVERAGE INCREASE CURVES



allow the lamb to stand on its four legs and drench slowly. The head should not be forced back, nor the drenching hurried, as either operation is liable to cause choking and possibly death. Drenches containing turpentine are likely to cause irritation and coughing no matter how carefully administered. A drench given as described passes—or at any rate, the great bulk of it—direct into the fourth stomach—the seat of the worm infestation—as was shown by experimenting with drenches of blue and killing the lamb immediately afterwards.

Table showing Weights in pounds of three Lambs from each lot at different dates.

Lot 1. Lambs fed on introduced grasses.
Lot 2. „ drenched monthly.
Lot 2c. „ controls to 2.
Lot 3. „ on licks.
Lot 3c. „ on licks and drenched.
Lot 4. „ controls in cattle paddock.
Lot 5. „ one drench during experiments.

Lot.	No.	9 Jan.	14 Feb.	12 Mar.	23 April.	25 June.	21 Aug.	24 Sept.	Total Increase.	Average Increase.
1	1	55½	36½	63	81	81	83	94	58½	62⅙
	2	36	57	66½	79½	82	81½	98	62	
	3	35	50½	59	74½	72	85	101	66	
2	1	26½	34½	42	52½	52	45	58½	32	28
	2	39½	47½	58½	65	62	52	65	25½	
	3	21½	31½	40	50	51	44	48	26½	
2c	1	30	39½	46	55	51	...	...	......	21⅓
	2	41	50	56	60½	55	51	60	19	
	3	24	32	36½	42	41	37	46	22	
3	1	26	37	40	42	39	40	...	......	27⅙
	2	39½	52	58	66	63	50	62	22½	
	3	30	42	47	55½	52	57	56	26	
3c	1	33½	44	49½	59½	55	...	...	......	27 1/12
	2	26½	38	43½	53½	52	50	56	29½	
	3	29	40½	45	50	50	49	57½	28½	
4	1	42	57	66	78	?	58½	46	4	27⅔
	2	28	41½	47½	59½	58	58	66	38	
	3	27	39	45	55½	52	59	68	41	
5	1	...	...	..	...	...	...	54	......	
	2	...	...	..	...	...	...	48	......	
	3	...	...	...	...	...	...	43	......	

Glancing at these weights, the most noticeable point is the contrast between the lambs fed on introduced grasses and the others. Then, the very fair progress of Lot 4, the controls which were placed in a paddock which had been rested from sheep for three years, and received no treatment, indicates the value of spelling and subdivision. The best contrast is furnished by Lot 2 and their controls, showing an average of nearly 7 lb. gain in weight (in favour of the drenched) between drenched sheep and those undrenched. There is but little difference between the drenched sheep, those given licks, and those given licks and drenched; but all show a far better result than the No. 2 controls, which were untreated, were running in the most natural conditions, and had not the benefit of feed afforded to Lot 4.

The average increase curve shows very markedly the difference due to the result of feeding on introduced and natural grasses in the New England district. It shows further that, apart from these well-fed lambs, those drenched showed the best results.

Wool, and the influence of arsenic thereon given in moderate doses for stomach worms.

As it is held by many that the administration of arsenic drenches has a deleterious effect on the wool, it was considered a good opportunity to practically test the accuracy of this opinion.

Throughout the experiment no wool had peeled off any of the sheep, and the length throughout, considering their condition and the various breeds represented, was good; in only one case, and that of a sheep which was not drenched, was the wool considered very short for the breed represented. It might be stated that on several previous occasions during the term of the worm experiments the sheep in each lot were examined, and in no case could any marked difference be observed as between those drenched with arsenic and the undrenched. Those that are comparable in every respect are Lot 2, which were drenched monthly, and their controls in the same paddock which were untreated; and Lot 3 which were given licks, and their controls in the same paddock which were drenched three times in addition. The other lots are only comparable to a certain extent as between the undrenched and drenched, since the feeding or lick conditions were different. Other particulars of the wool of the weighed sheep on 24th September at the end of the experiment are as follows:—

Lot.	No.	Adherence to Skin.	Soundness of Staple.	Condition of Yolk.
1. Fed on introduced grasses.	1	Slightly loose ...	Sound	Fair amount of yolk.
	2	Very tight .	Very strong... ...	Plenty of yolk.
	3	Fairly light ...	Sound	do do
2. Drenched ...	1	Slightly loose ...	do	Yolk fair.
	2	do do ...	Strong	do
	3	do do ...	do	Deficiency of yolk.
2. Control untreated.	1	(Dead)	....	. .. .
	2	Slightly loose ...	Strong	Very deficient in yolk.
	3	Fairly loose ...	Fairly strong, very short.	Not much yolk.
3. On licks ...	1	(Dead)	.. ..	....
	2	Fairly tight ...	Sound	Dry, and devoid of yolk.
	3	do do ...	Strong	Very little yolk.
3. On lick and drenched.	1	(Killed)	....	....
	2	Fairly tight ...	Sound	Plenty of yolk.
	3	Slightly loose ...	Rather tender ...	Yolk dry.
4. Controls ...	1	Fairly tight ...	Sound	Very little yolk.
	2	do do ...	do	Fair amount of yolk.
	3	Tight	do	do do

NOTE.—The wool on those sheep reared on cultivated pastures was in better condition than the others throughout, and the fleeces would probably weigh much heavier, but in length of staple they did not appear to have any advantage.

Conclusions.

In the first place the whole experiment may be regarded as a triumph for "feed." It is only necessary to consider the weights and the soundness of the wool of Lot 1 to see that worm infestation even to a considerable extent is practically harmless as long as the food supply is abundant and nourishing. Lot 4 shows this to a less extent as a result of fair feed in a paddock spelled from sheep for some time. Secondly, drenching has an obviously good effect, by reason of its action on stomach and intestinal worms, but it must not be expected to cure "lung worm" infestation, although the sheep being relieved from the stomach parasites will be able better to resist the "lung-worm."

Thirdly, drenching with arsenic has, so far as one can judge from these experiments, no deleterious action whatever on the sheep, and if properly prepared, causes no internal irritation.

Any farmer troubled with worms in sheep will find his best remedy in providing feed, which can be greatly assisted by subdivision and spelling of paddocks, burning off the grass occasionally, fencing-off swamps, &c., providing a lick as was used in these experiments, or drenching.

It is quite evident that he can hardly hope to get rid of these parasitic worms entirely, but he can, by keeping up the strength of the sheep, or more especially by giving the lambs a good start in life, enable them to successfully resist the parasites.

Dry Farming Congress.

It is impossible to overestimate the value of the Dry Farming Congress of America. Beginning a few years ago as the Trans-Missouri Dry Farming Congress, the organisation has now been completed on international lines, having but one object—"The further development of agriculture throughout the world by the utilisation of scientific and sensible methods of conservation and cultivation where irrigation is impracticable or impossible." At the Fourth Annual Session, last year, there were official delegates present from two provinces of Canada, Mexico, Turkey, Germany, and Hungary. Eleven hundred delegates were assembled from the States, Territories, and nations represented. The Hon. J. H. McColl, President of the Senate of Australia, is Vice-President of the Australian section.

The Fifth Annual Session will be held at Spokane, Wash., U.S.A., on 3rd to 6th October, 1910. The Executive Committee desire to enlarge the membership of the Congress in Australia, and invite suggestions founded on Australian experience. The Secretary-Treasurer is Mr. John T. Burns, 407, Temple Court, Denver, Colo., U.S.A.

Willows as Stock Food and Shade in Summer.

R. W. PEACOCK.

Many stockowners have not yet realised the value of willows, but they are fully appreciated by those who have them in periods of drought when fodder is scarce, and stock in considerable numbers have been kept alive on willows throughout our ever recurring droughts. That cattle and sheep relish them has ample testimony in the branches closely clipped as far as the sheep can reach in sheep paddocks, and to a higher level in cattle paddocks; this too when food is plentiful. In droughts every leaf that falls is greedily eaten, even when yellow in the fall of the year.

The following analysis of a sample of willow leaves has been furnished by Mr. F. B. Guthrie, Chemist of the Department:—

Moisture	70 92 per cent.	Carbohydrates ...	13·58 per cent.
Ash	3·00 ,,	Ether Extract—fat or oil	1·26 ,,
Fibre	4·56 ,,		
Albuminoids ...	6·68 ,,		100

Nutritive value, 23; Albuminoid ratio, 1 to 2·4.

The stockman, to assist the stock to get the fodder. cuts down the branches, which does not harm the tree, but frequently increases its vigor. Lashing the limbs with a chain fastened to a stick has been practised, but the axe should prove more economical.

Fig. 1.—Weeping Willow.

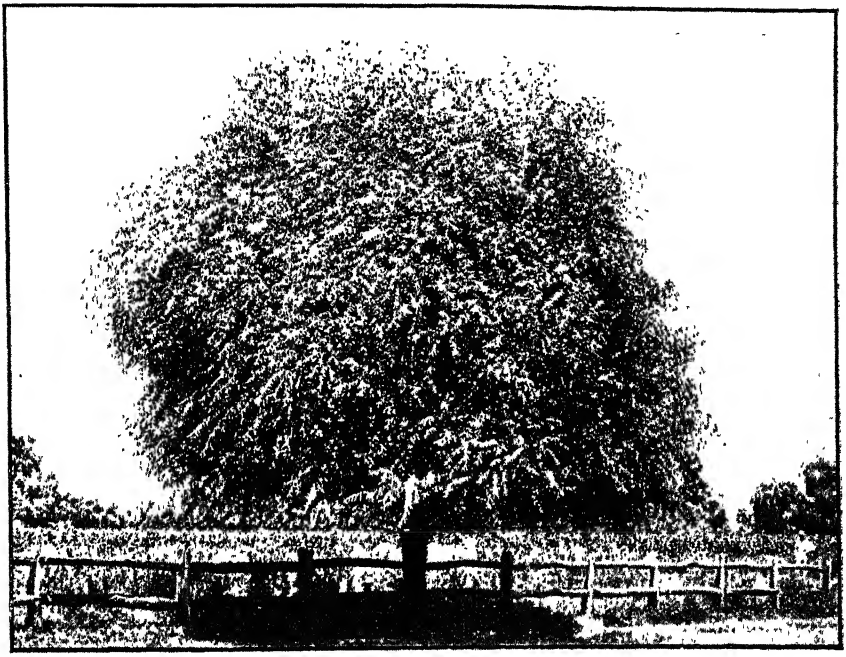


Fig. 2.—Common Basket Willow.

There are many varieties, the two most common ones being the weeping-willow and the common basket-willow. The latter is the hardier upon upland soils away from permanent water. They grow luxuriantly upon rich alluvial soils adjacent to running streams, where the free water is within 30 feet of the surface, in the temperate districts of this State. Adjacent to streams they throw out large quantities of roots into the water, which form large mat-like growths, preventing erosion. On account of this habit they are valuable where erosion of the banks is to be feared, and are largely used to prevent such. Owing to the same propensity they may cause considerable damage by choking up water channels upon level country, thus leading to the flooding of the alluvial flats or the cutting of other channels.

The planting of willows along sluggish watercourses is to be deprecated for the above reasons. A few willows at the head of such a stream may do untold damage owing to the ease by which they are propagated; the smallest branch may be washed down the stream and become as large as the parent tree, and this may continue until the channel is completely choked. The ease of propagation is frequently exemplified, under favourable conditions, by the manner in which fence posts cut from willows often grow into trees. These huge cuttings contain a considerable store of plant-food built up from previous years' growths. Rails of fences cut from willows during the winter frequently send out many shoots in the spring, which eventually die. It will thus be seen that they grow readily from cuttings.

Fig. 3.—Willows planted in bottom of dry creek.

Fig. 4.—Willows along watercourse.

The cuttings should be about 10 to 12 feet long and 3 to 6 inches in diameter. The length keeps the top shoots out of the reach of stock. From these shoots the branches are formed, the remainder of the cutting ultimately forming the trunk of the tree. The cuttings should be sunk 3 to 4 feet deep and tightly rammed. Stock should be kept from rubbing against them or destroying the bark.

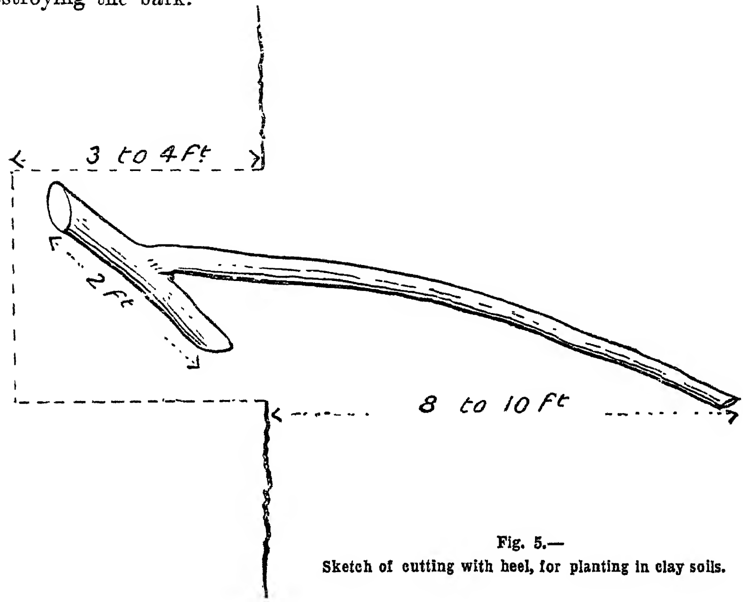


Fig. 5.—
Sketch of cutting with heel, for planting in clay soils.

Such straight cuttings are satisfactory upon sandy loams, but may fail upon clays if the summer turns dry. The clay soils shrink from the cuttings, and the young roots are lacerated. In order to prevent this, the cuttings should be made with a heel about 2 feet in length, the main portion of the cutting being a limb of sufficient size branching from another limb, a portion of which forms the heel. This method prevents root laceration, whether due to the shrinkage of the clay or to shaking by winds or stock.

When planted away from ideal situations, such as on the uplands, positions should be chosen which receive additional moisture from stormwaters from adjacent areas. Sandy outlets from gulleys are suitable. Many dry creeks could be checked by planting them along the beds in positions slightly away from the force of the current at flood-time. The practice of planting them on the banks of such creeks is so much waste of time.

The best time to set out cuttings is just before the bursting into leaf in the early spring.

The value of these trees as a summer shade more than repays the trouble of planting. The contentment so frequently seen of cattle and sheep ruminating in the shade of the willows along the watercourses on a hot summer's day must in no small measure be reflected in the owner; and apart from the

utilitarian aspect the æsthetic side of our nature is appealed to by the sight of the vivid greens of these graceful trees hugging the meandering streams of fertile valleys.

Fig. 6.—Avenue of Willows.

FRIENDLY INSECTS.

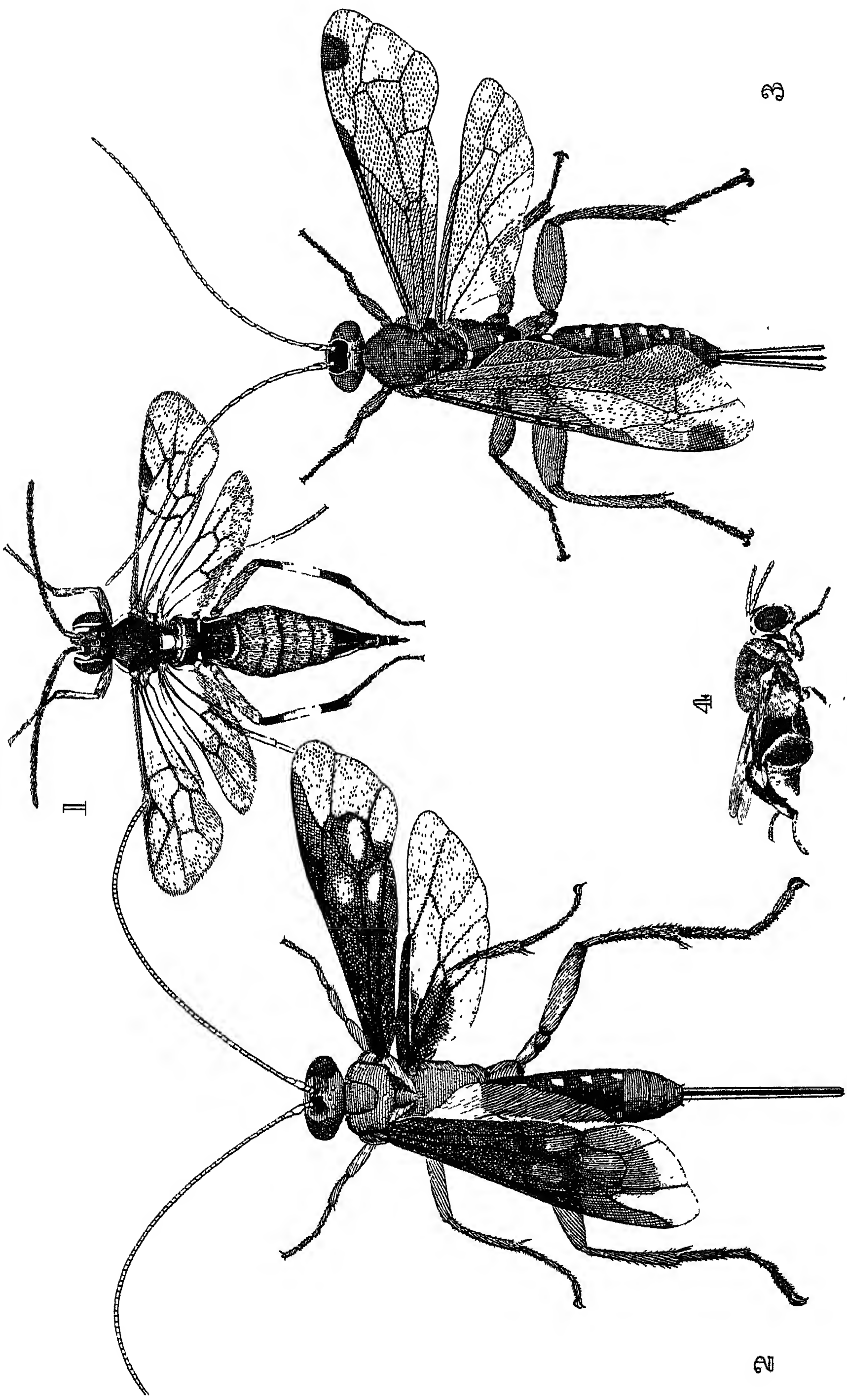
EXPLANATION OF PLATES.

PLATE 1.

1. Ichneumon Wasp (*Bassus laetatorius*), which destroys the larvæ of the syrphid flies. (Enlarged.)
2. Ichneumon Wasp (*Rhyssa semipunctata*), a useful parasite which destroys cut-worms and many other moth caterpillars. (Enlarged.)
3. Ichneumon Wasp (*Pimpla intricatoria*), a useful parasite upon vine moths, cut-worms, and other caterpillars. (Enlarged.)
4. Chalcid Wasp (*Chalcis phya*), which lays its eggs in the larvæ of small moths. (Much enlarged.)

PLATE 2.

1. Large Brown Mantis (*Archimantis latistylus*), which hides among foliage, and captures and eats many destructive insects that are feeding upon plants.
2. Egg Case containing the eggs of the Large Brown Mantis. The eggs are placed in double rows in the centre of the mass, opening out into the stripe down the middle. The papery substance surrounding the eggs, which are all glued together, is soft and sticky when deposited by the mantis but hardens as soon as it dries. These egg masses should never be destroyed.
3. Slender-shouldered Mantis (*Mantis sp.*), which is common in gardens, hiding among foliage and destroying moths, flies, and other insects.
4. The Thick-shouldered Mantis (*Orthodera ministralis*), a handsome little green mantis which lives in the gardens and among foliage, and destroys many small injurious insects.
5. Egg mass of the Thick-shouldered Mantis, showing baby mantis just emerged. These eggs are found attached to fences or old walls.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Friendly Insects

WALTER W. FROGGATT, F.L.S., Government Entomologist.

To the economic naturalist there are only two kinds of insects, injurious and beneficial. The first comprise an immense number of different insects that do all sorts of damage in the house, the garden, the orchard, and the field; and these can be again subdivided into a number of well-defined groups. In the second, the beneficial or useful insects, with which this paper deals, we can again make a number of smaller divisions; but, broadly speaking, the insects usually known in economic entomology as "useful" insects are those that are parasitic upon, or eat up, insects attacking and damaging crops.

A great deal has been written about the uses and great value of the insects that live upon other insects: and when one knows the immense number of eggs a moth can produce, or the rapidity with which a parent aphis or plant louse can found and multiply a colony of her kind, one can understand that if there were not these natural checks upon the increase of caterpillars, scale insects, aphides, locusts, etc., there would be such an overwhelming mass of pests infesting our plants that it would be hopeless work to try to grow crops of any kind. In spite of useful insects, however, there is always a certain percentage of injurious insects that escape and are sufficient to carry on the next generation. We usually find that it is a case of supply and demand; if the pest is abundant the useful insects also appear in quantities, so that Nature keeps up the balance of power.

Under the natural conditions of virgin countries, uncultivated trees and shrubs are more hardy, and do not suffer so much from either insect or fungus attacks as the more delicate cultivated plants.

Under the altered conditions caused by the destruction of forests, fodder and native grasses, injurious insects often increase so rapidly that they outstrip their insect enemies, who are also aided by birds and other predaceous creatures, most of which forsake the country when it is denuded of its native vegetation. Hence we get insect plagues; and though we cannot leave the protection of our crops altogether to our useful insects, but must also take mechanical methods of subjection such as fumigation, spraying, and destruction of all damaged wood, foliage, and fruit, yet we should do all in our power to protect and encourage our useful insects, which play an important part in the work of safeguarding our crops.

Though a careful observer is soon able to separate the useful and injurious insects from each other by noting their feeding habits, through the want of this observation thousands of very useful little creatures are destroyed every season by an otherwise careful orchardist and farmer.

It is therefore proposed in these notes to explain some of the distinctive points of our useful little friends, so that the man on the land will take care of them. As a case in point: a garden plant is often badly infested with

some minute scale or thrips which does not catch the eye of the farmer, who notes only that the plant is sick. But later on, when some species of small ladybird beetle, attracted by a new food supply, swarms over the bush to feast upon the insignificant pest, he notices these at once, and concludes that they are the cause of the ill-health of his plant, and destroys them as a pest instead of the scale or thrips.

The object of this paper is to give, by illustrations, and a simple plain description of each group of useful insects, such information that every person will be able to recognise his friends, and will stay his hands when about to destroy eggs, larvæ, or perfect insects, until he is certain that it is not a friend.

Taking the friendly insects in order: those known as external feeders are the best known, for they can often be observed devouring or carrying about the remains of injurious insects upon which they have dined.

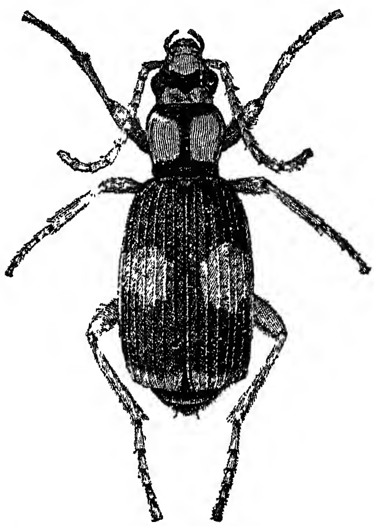


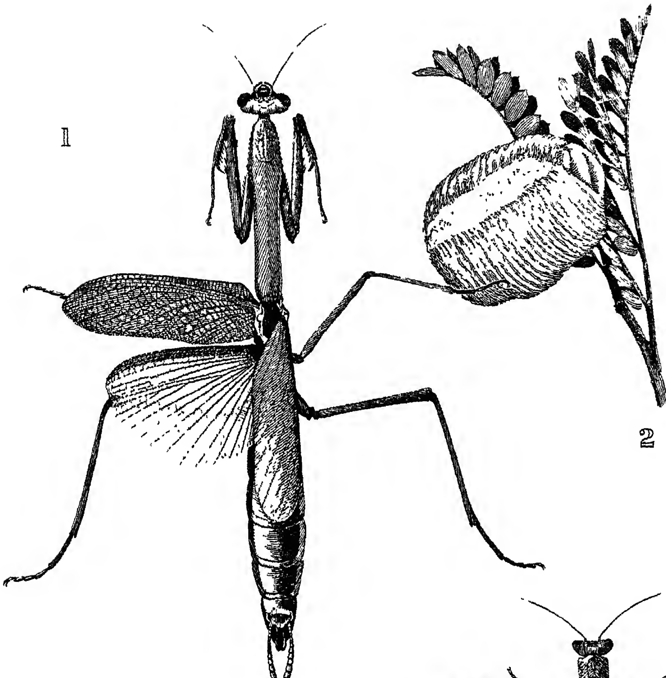
Fig. 1.—A carnivorous beetle, the "Yellow Bombardier Beetle" (*Pheropsophus verticalis*).

Type of ground beetle that destroys many injurious insects. This insect is found under stones and logs, and when touched discharges a puff of acrid gas, from which it takes its popular name. (Enlarged.)

The predaceous ground beetles comprise a very important group, as both in the larval and perfect beetle state they live altogether upon other insects, most of which are plant-eating. A good example of this group is the shining green carab (*Calosoma Schayeri*). The larva is a short white grub with three pairs of legs; a black head covered with horney plates and furnished with stout biting jaws. It lives in holes in the ground, where it changes into the perfect beetle, or, if in cultivated fields, under loose clods.

When an army of cutworms appears in a cultivation paddock, many of these handsome beetles may frequently be observed following them up. Some years ago thousands of these beetles appeared in the streets of Sydney, climbing up the park railings and the sheltering angles of the buildings, while at the Central Railway Station thousands were crushed to death crawling over the pavement. It is probable that it is more in the destruction of the eggs of ground-laying insects that the smaller carab beetles do most important work.

The Ladybird beetles are the best known of all our friendly insects, because they are so much in evidence on aphis-infested fields or scale-infested trees. Australia is very rich in species of ladybird beetles, and many have been collected from this country and sent to foreign lands not so rich in them in the hope that they would be as useful there as here; but with a few noticeable exceptions they have not thriven as well as in their native land.



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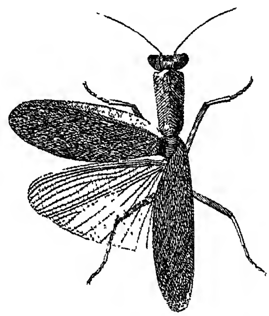

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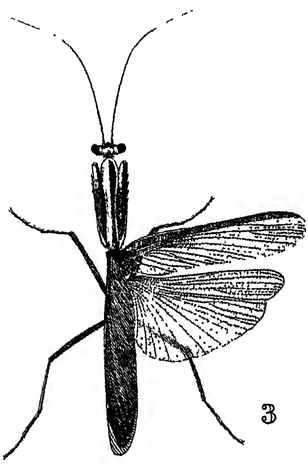

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The eggs are usually yellow and deposited upon the bark of the tree in little clusters, attached at the base, with the elongate ends pointing upward. The larvæ or grubs have many different forms; but generally they are active little black or brown creatures marked with yellow, sometimes covered on the back with short spines, as in the steely-blue ladybird. They crawl about amongst the infested foliage, feeding upon the small plant-infesting scale-insects, plant-lice, and any other small insects or mites that come in their road. When full-grown they hang themselves up by the tip of the body to the leaf or bark, looking like little yellow or brown bundles; their outer covering or skin splits within a few weeks (or even days in mid-summer) down the back, when the perfect round-backed, yellow-spotted, brown, black, or shining-blue beetle crawls out, and at once commences to feed in the same manner that the little grubs did previously.

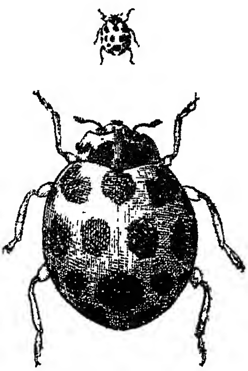


Fig. 2.—The Spotted Ladybird Beetle (*Leis conformis*).
A deadly enemy to all kinds of aphis or plant lice. Yellow orange colour with black spots.

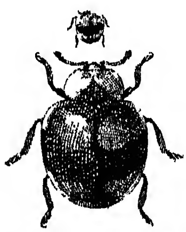


Fig. 3.—The Bi-coloured Ladybird Beetle (*Thea galbula*).
Is bright yellow and black, the latter forming a regular pattern across the yellow. It feeds upon aphis and young scale insects.

Orchardists and gardeners should never destroy such yellow eggs upon the bark or foliage of trees and plants, until they are perfectly certain that they are not those of ladybird beetles; for each little spindle-shaped egg will give birth to one of the most useful little insect friends that can eat injurious insects, and so assist the farmer. The curious compact pupæ into which the little grubs change should also be carefully preserved, and no one allowed to crush them when hanging on the tree or plant; for each one contains a larger and more formidable friend, who not only eats the scale insects, but who also reproduces its species, so that in summer time it soon increases to such numbers as to completely eat out the bulk of the injurious insects.

Now we come to the perfect little ladybird beetles of various shades and sizes, but all with a certain similar form, and all carnivorous in their habits. There are certainly a large number of destructive insects that have a somewhat general resemblance to the true ladybird beetles, and in consequence might easily be mistaken for ladybird beetles by a superficial observer; and it is this similarity that has caused the destruction of many useful insects. By placing the beetle in a jar or glass with some aphis or scale and leaves,

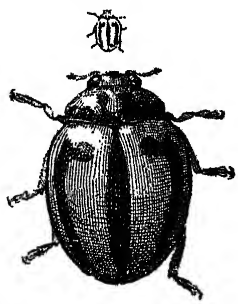


Fig. 4.—The Striped Ladybird Beetle (*Verania frenata*).
A dull yellow coloured beetle with three black lines down the back. It feeds upon aphis.

and by noting which food it ate, it would be a simple matter for a gardener to prove for himself whether the beetle under observation was a plant-eater, and therefore an enemy, or a savage insect-eater, and therefore a friend.

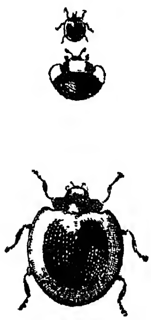


Fig. 5.—The Steely Blue Ladybird Beetle (*Orcus chalybeus*).

This beetle is of a uniform rich metallic blue tint. It feeds upon scale on citrus trees.

One of our common and most useful ladybird beetles devours the mealy bugs upon the trunks of our ornamental Bunya pines; when feeding in the larval or grub state it is clothed all over the upper surface with white filaments and a floury substance that gives it the exact appearance of a mealy bug, so that on many occasions when congregated together they have been sprayed and scrubbed off the trees under the mistaken idea that they were mealy bugs. If in any doubt about this species, the observer should turn the suspected scale insect over on its back; if it is the useful larva he will easily see the three pairs of well developed legs and biting jaws of the head; if it is a scale, the legs very small, and there will be no biting jaws, and the whole insect will be more irregular and thickened in form.

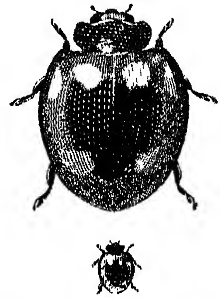


Fig. 6.—The Six-spotted Ladybird Beetle (*Orcus australasiae*).

A handsome rich metallic blue beetle spotted with yellow, larger than the last species. It feeds upon red scale, San José scale, and other pests.

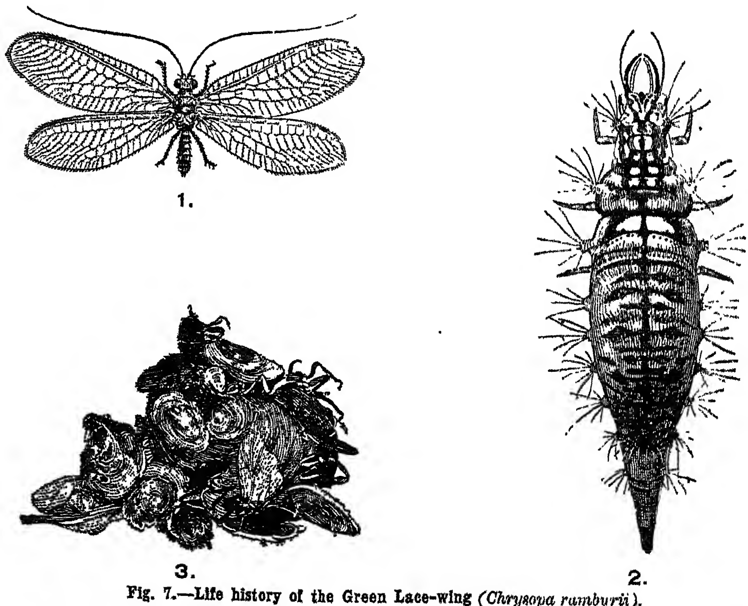
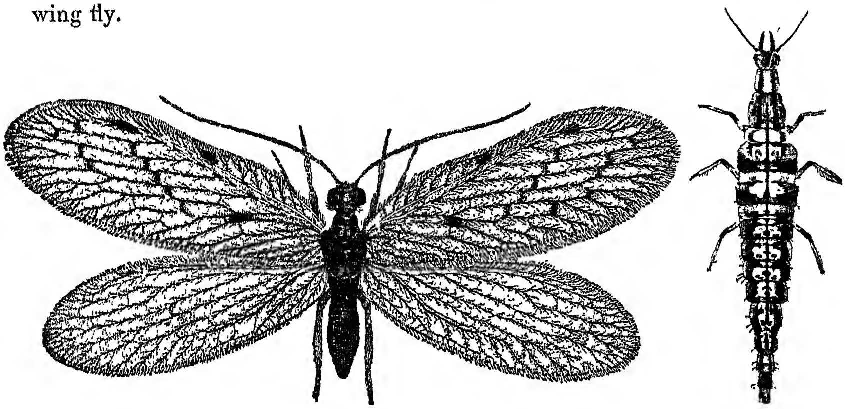


Fig. 7.—Life history of the Green Lace-wing *(Chrysopa ramburii)*.

1. The perfect insect. 2. The active larva. 3. The enclosed pupa with the cocoon, covered with the remains of dead scale insects.

Lace-winged Flies or Ant-lions.—The lace-winged flies are often known as ant-lions, because a certain group of them in the larval state live in circular pits in the sand, or hidden under bark and logs, and they catch and eat ants. The group most useful to the orchardist are, however, those that lay their little white eggs—usually attached to stalks—upon the foliage of cultivated plants; from each of these curious stalked eggs emerges a queer little tick-like creature with well developed legs, a rounded, spiny or hairy body, short neck, broad head furnished with projecting eyes, and large, curved, hollow jaws, by which it can transfix the insect-pest and suck up all its blood. These little creatures very frequently cover their backs with bits of dirt, dust, and the remains of their food, so that until one is removed from the plant its outline is quite hidden. When fully fed, this active little creature, which has spent all this stage of its life devouring aphis, scale, and other pests, attaches itself to a leaf and produces a round, clear, parchment-like cocoon, under cover of which it pupates and changes into the adult lace-wing fly.



1. 2.

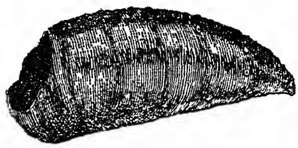
Fig. 8.—Life history of the Brown Lace-wing *(Micromis australis).*

1. The perfect insect (much enlarged). 2. The active larva (much enlarged.)
This insect feeds upon scale and aphis on orange-trees.

The perfect insect has a rounded head furnished with powerful jaws, large, projecting, often brightly-coloured eyes, and it is attached to the body by a short neck. The legs are well developed; the body slender, rounded at the tip; and the slender rounded wings covered with a close, irregular network of cross veins, which, though ample in size, are weak for sustained flight. Except in the smaller forms these lace-wing flies do not fly very well. In general colour they are usually brown, grey, or green in tint, and when at rest fold their wings straight down over the back. The eggs, larvæ, pupal case, and perfect insects should be easily recognised from the above description, and the gardener can at once be sure that any creamy white eggs in clusters on a leaf, each with a slender stalk, are the eggs of these useful insects, and they should not be destroyed.

On an aphis-infested tree, or where all kinds of mealy bugs are infesting a plant, these slender or rounded little creatures are to be found crawling about among their food supplies, but often so carefully disguised by the load of dirt upon their backs that only the projecting jaws are visible If doubtful about their identity, put a few of them under a glass with some aphides, and one can soon prove whether he has got the right friend.

1.



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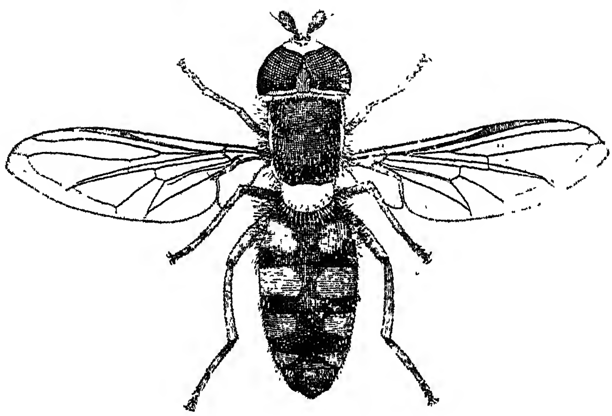


3.

Fig. 9.—Life history of Syrphid or Hover Fly *(Psilopus sydneyensis).*
A deadly enemy to rose, peach, and other aphis.
1. Pale green larva. 2. Hard pupa case. 3. Perfect fly. (All much enlarged).

Where the little brown lace-wing (Figure 8) is common on orange trees, one has only to take an open umbrella, shake a few branches over it, and a few will soon be seen fluttering about on the silk. One of the large green lace-wings is often in summer-time attracted to the lamp, and can be easily recognised by its delicate green colour, bright metallic eyes, gauzy wings, and very objectionable smell.

Two-winged Flies.—The most important group of these useful insects belong to the Syrphid or Hover flies. The flies, which are very common, particularly in the early summer, in our gardens and orchards, are very conspicuous from their brightly-banded yellow and dark-brown or black bodies, with delicate, transparent wings. They hang over a flower or aphis-infected plant with their wings moving so rapidly that they appear to be stationary in the air. Though not much larger than a house-fly, except in the length of the body, few gardeners have failed to notice these dainty and very useful flies. When in the larval or grub state they devour injurious aphides, and when adult they fly from flower to flower, carrying the pollen grains about, and therefore are an important group of insects in carrying out the cross-fertilization of flowers.

These flies deposit their delicate white eggs upon aphis-infested foliage; from these eggs hatch out elongate, dull-white to semi-transparent maggots, which are furnished with fine, black, hooked jaws that can be extended or retracted when devouring aphides. All their maggot life is spent in eating plant-lice or aphides, and they can be easily observed upon a peach tree or rose bush, for when moving along they can also elongate the segments of their bodies to about three times their usual length, so that they are either short pear-shaped creatures or elongate maggots, contracting or extending like a concertina. When full-grown they contract into an oval or pear-shaped form; the outer skin hardens into a yellow or brownish shell, which is really formed of the skin of the adult maggot. The pupal cases are frequently attached to the food plant among the aphis, but many also fall to the ground. In the maggot stage these flies play a very important part in clearing plants of aphides.

There are several other groups of flies that contain parasitic species; such is the Golden-faced fly (*Sarcophaga aurifrons*), which is common around pig-sties and offal in the country. The eggs are deposited on the living insect or larva. Some of these destroy grasshoppers. A number of other similar parasitic flies can be bred from the cocoons of moths and other insects.

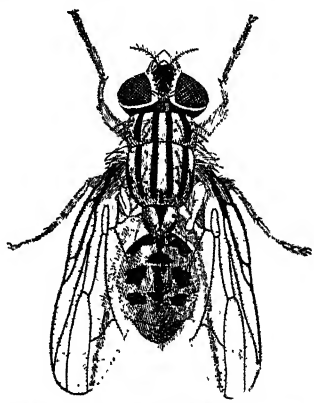


Fig. 10.—The Golden-faced Fly (*Sarcophaga aurifrons*).

Which lays its eggs upon living plague-locusts and other insects. The maggots feed in the body of the locust and then emerge, pupating in the ground. (Much enlarged.)

The Robber Flies are another group of large and powerful flies very common in the interior. They have stout beak-like mouths, and having captured another insect, which they hold in their strong legs, they suck the blood out of it while flying about.

Hymenoptera.—Internal Parasites.—The useful insects which belong to the internal parasites take a very extensive and important part in the work of keeping all kinds of injurious species in control. They vary in size and shape from large ichneumon wasps to tiny little creatures hardly visible to the

naked eye. It is safe to say that nearly every insect has some other insect that attacks and devours it to a greater or lesser extent—deposits its eggs upon the surface of its body, or else with its wonderfully constructed ovipositor inserts the egg beneath the skin of its victim.

These insects have been collected from and studied all over the world during the great development of economic entomology in the last twenty-five years.

The first group are the larger wasps belonging to the *Ichneumonidae*, or, as they are commonly called, Ichneumon flies Many of these are large wasps, with stout wings traversed by well-defined veins, and furnished with slender many-jointed antennæ and large eyes; and their jaws are well developed, though they chiefly suck up honey and the sweet secretion of flowers. The shape and length of the hair-like ovipositor, formed of several bristles and an elongate egg tube, is very distinct in the different groups; but it is always adapted to the habits of the particular grub, caterpillar, or larva in which it deposits its egg. Thus, those that place their eggs in hidden larvæ, or grubs feeding in wood or other substances, have very long "tails"; while the ichneumon that attacks a grub feeding in the open upon a leaf can get along with a very short one.

No ichneumon wasp can sting; for the stinging apparatus of these insects is aborted into the egg-laying ovipositor. Therefore they are quite harmless, though the horny tip of the ovipositor of those in which this appendage is very short may sometimes be stiff enough to prick like a pin, when the wasp is carelessly handled. Hence all slender bright-coloured wasps with usually clear wings, and which have long hair-like tails, should be protected and not destroyed.

Though some of these do infest beetles and other groups, it is among the caterpillars of the many destructive moths that the larger ichneumons do an immense amount of good. As a general rule they puncture the skin of the grub and deposit a single egg under the skin; the resultant soft, legless maggot, feeding upon the soft tissues, gradually devours the whole of the flesh until there is nothing left but the outer skin, and under shelter of this skin the full-grown ichneumon parasite constructs a stout cocoon, in which it pupates, and when ready to emerge it escapes by gnawing a small circular hole through the side of the cocoon.

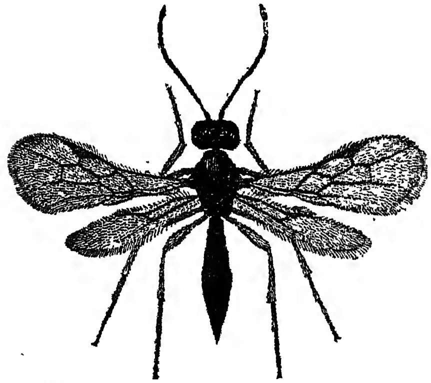


Fig. 11.—A parasitic Braconid Wasp ***(Ephedrus persicæ).***

Which lays her eggs on the body of the wingless peach aphis.

The second group comprise the *Braconidae*, or Braconid wasps, which resemble the large Ichneumons in general structure; but they are often very small, and have not so many cross veins in the wings.

They also either deposit their eggs in the bodies of moths, caterpillars, and grubs; or else confine their attention to aphis and plant lice of all kinds. They may deposit a great number of eggs in a single grub.

When these internal maggots have devoured the whole of their host, they crawl out of the remaining skin, and each one spins a little white, egg-shaped silken cocoon. These cocoons often form a regular mass, containing many hundreds, enveloped in a mass of curious cotton-wool-like substance; however, the latter is often wanting.

These clusters of little cocoons can be often noticed on the grass stalks in fields where the cut-worms have been swarming; they are often thought by farmers to be "caterpillar eggs," and are destroyed by them in consequence. These cocoons should never be damaged, but preserved, for later on they will bring forth a crop of active little wasps, ready to kill many injurious grubs.

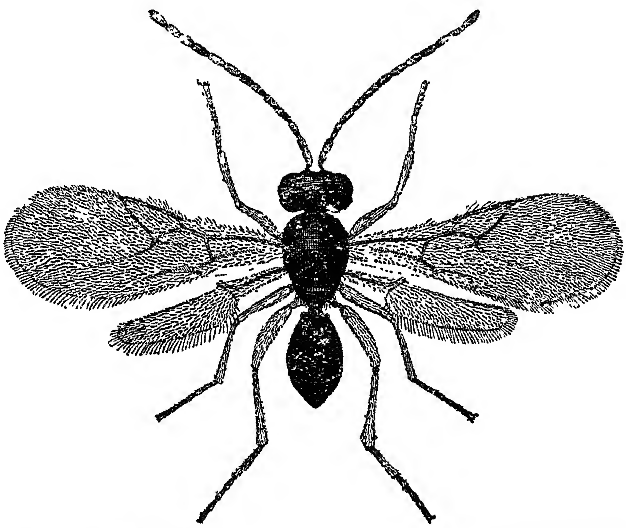


Fig. 12.—A Cynips Wasp (*Hypodeianchis aphidis*) that destroys the peach aphis.
(Much enlarged.)

There is another group of the Braconid wasps that are almost confined to plant-aphis. They puncture the aphis and deposit the egg beneath the skin. The little maggot feeding inside the aphid soon empties out all the juice and then pupates. If one examines the insects upon an aphis-infested cabbage leaf he will notice many aphides, dry, discoloured, and apparently lifeless, of a different colour to the living ones, and swollen and shapeless. These remain firmly attached to the surface of the leaf by their claws, and later on the imprisoned wasp gnaws its way out through a hole in the side of the aphis skin and comes forth a shining black wasp, ready to start fresh parasites among the remaining aphides. Nearly every species of plant-aphis has some small *Apanteles* wasp parasite that (late in the season in particular) will kill off a very large percentage of the aphides.

The parasite of the cabbage-aphis is one of the most useful, and is now cosmopolitan in its range, being spread from Europe to Australia.

The third group of internal-feeding parasitic wasps is divided into several large families for the purposes of classification, but can be here treated under the term of micro-hymenoptera (minute wasps).

They comprise thousands of the most beautiful and often most curiously formed little creatures in the insect world; while some are rich in bright metallic tints, others are dressed in black with the usual prim wasp-like form. They differ from the former groups in the structure of the antennae, and in having hardly any cross or parallel veins in their delicate gauze-like wings; while most of them are very small and many microscopical, those of the

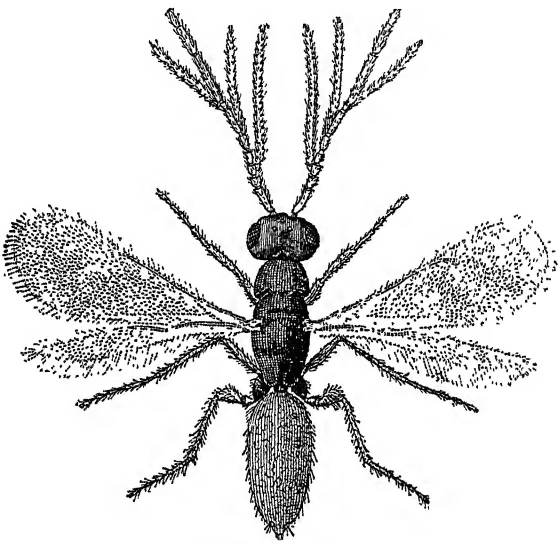


Fig. 13.—A Chalcid Wasp (*Ceraphron niger*).

Which has been introduced into Australia with the Leaf-mining Fly, *Phytomyza affinis*, upon which it is parasitic. (Greatly enlarged.)

group with extended tail, reaching ¼ of an inch in length, being the giants. In summer the bush, garden, orchard, and field swarm with countless thousands of the smaller forms of these parasites; nothing is too small for them to infest. One group lay their eggs in the eggs of spiders. Others insert their ovipositors through the protective covering of the mantis eggs and discharge their egg therein. Another black ant-like wasp infests the eggs of grasshoppers, and several curious species can be obtained from the pupæ of our large bull-dog ants.

To the farmer, however, the most interesting are those which destroy the small moth caterpillars, of which there are many. The best known are the Chalcid wasps, short, thick set, hard, shining black and yellow wasps, which have the thighs of the hind legs so thickened that, drawn down on either

side of the abdomen, they are often quite as large as the short oval body. All the members of this group are parasitic on the larvæ of small moths. One attacks the codlin moth, and is known as "the jumping fly," because it has the power of springing up by contracting the swollen thighs.

If anyone wishes to observe these little friendly insects he has only to collect a bunch of galls off a gum tree, some insect eggs or cocoons, and place them in a closed glass jar, where in a few weeks he will see these little creatures crawling over the surface of the glass trying to escape.

A very curious fact in the development of some groups of these tiny parasites has been discovered within these last few years, namely that the ovum or egg deposited in the caterpillar swells out and divides into a number of separate eggs, each capable of producing a perfect wasp, so that each egg deposited by the parasite multiplies into many. This discovery explains the rapidity of the increase of many of these minute creatures.

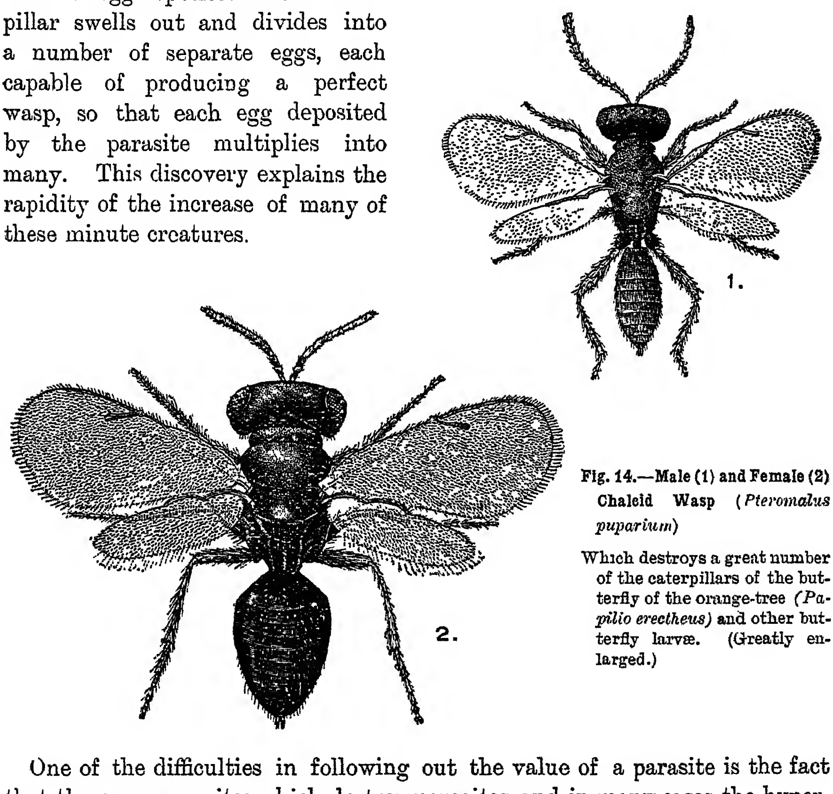


Fig. 14.—Male (1) and Female (2) Chalcid Wasp (*Pteromalus puparium*)

Which destroys a great number of the caterpillars of the butterfly of the orange-tree (*Papilio erectheus*) and other butterfly larvæ. (Greatly enlarged.)

One of the difficulties in following out the value of a parasite is the fact that there are parasites which destroy parasites, and in many cases the hyper-parasites are just as numerous as the useful parasite, so that the economic value of such a parasite is discounted as far as the farmer is concerned.

Carnivorous bugs.—Among the hemiptera comprising the plant bugs there are several groups which are carnivorous in their habits, and instead of sucking up the juice of plants, confine themselves to the blood of other often destructive plant-eating insects. One group are known as "assassin bugs" on this account, and under natural conditions they must clear off an immense number of more or less injurious insects.

One of our best economic species is the *Vine Moth Bug*, which also attacks several other leaf-eating larvæ, such as the fig-leaf beetle. These shield bugs run about over the foliage and stick their beak like mouth into the body of the Vine Moth caterpillar; they suck up its blood, and then after having shaken the skin off their beak they start afresh. They can be very easily watched while at work, and the observer will soon be able to prove whether it is this useful species which he has among his vines, and can then protect them and their clusters of rounded, shining star-capped eggs which will be found deposited upon the leaves.

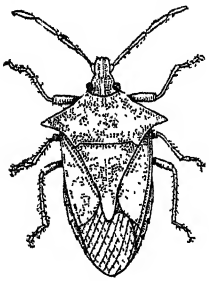


Fig. 15.—Vine Moth Bug (*Oechalia schellembergi*).
This bug is very active in destroying the caterpillars of the Day-flying Vine Moth, and also the larvæ of some chrysomalid beetles.

Useful orthoptera.—The smaller forms of the *Praying Mantis* are sometimes very common in gardens, but from their wonderful protective colouration are not very noticeable. They lay in wait among the foliage and capture any incautious insect that comes within reach. The curious egg-capsules are formed of a brown papery-like substance containing several rows of eggs, and are attached to twigs and fences; they should never be destroyed, for one of the larger ones may contain many hundreds of small predaceous creatures, in embryo, which on emergence devour all kinds of tiny pest insects.

Useful Moths.—Though nearly all the moths are injurious insects, we have one small family represented by a number of species in which the caterpillars feed upon scale insects. These pretty little grey, brown, or white moths deposit their eggs upon scale-infested twigs. From these eggs come forth short, thick set, white grubs, more like the larva of a *weevil* beetle than a moth. These grubs feed exclusively upon the surrounding scale, at the same time constructing a stout coat with silken strands and the remains of the shell of the coccids they have devoured, and under its protection they move about and devour the scale until they are full grown. Then they turn their loose jacket into a much stouter oval cocoon and attach it to the twig among the remains of the scale, in which they pupate. They are chiefly found upon the white egg-like *Eriococcus* which infests the twigs of the gums trees in the bush; but they also come into the orchard and in a similar manner destroy the "black bug," or olive scale, upon the citrus trees. Whenever an orchardist notices a number of these large masses among the scale, if he turns one over, and finds it contains a grub, and he sees that they are numerous, he should not harm them, and could leave the spraying of that particular tree until the moths have emerged, when he will only have to kill with the spray the scales and larvæ which the grubs have missed.

In conclusion, I would point out that every person who becomes interested in the workers of what we might call the "unseen world" around him, will find, besides the benefit that he will derive from protecting useful insects, that he can learn many interesting facts from a study of natural history.

The Artificial Brooding of Chickens.

A. L. WYNDHAM.

FOR the raising of incubator chickens the writer prefers a double-compartment foster mother, with the floors of both compartments on a level. Where one floor is lower than the other, chills occur through the chickens not having sense enough to go back for a warm by themselves. This trouble is seldom met with when the floors are level. More than two compartments seem a doubtful blessing, as the necessary cloths to retain heat quickly get dirty, and, if any disease is about, act effectively in breeding germs. No doubt they can be, and are, cleaned by dusting with earth and ashes, &c., but the writer's opinion is that proper deodorisation can only be done by thorough washing or changing.

Simplicity in construction is the way to success.

A brooder without legs, built close to the ground, is the most convenient to get the chickens back into; where a runway has to be built up to the entrance there is always some doubt of their climbing up of their own accord. For security in this direction the writer has always built low board walls, sloping up to the entrance of any brooder.

Then as regards the lids or tops of the brooders—those in which a glass window is let in, so that the chicks can see you before opening up, are the best. The opening of a brooder without a window generally gives the young birds a fright.

Ventilation from the bottom of the brooder upwards and outwards gives the best results. The fresh air is generally conducted past the heating apparatus to draw it in and warm it.

Brooders supplied with hot-water pipe and lamp are the most to be depended upon, and cheapest to run. Where a lamp large enough to heat without a radiator is provided, it burns too much oil—then the radiators get out of order—but with water and lamp, you get a small consumption of kerosene, and if the lamp does go wrong there is something to maintain heat for an hour or two. The water wants to be put in hot, and renewed every eight weeks. A compact regulator would be a great boon. At present too little attention is paid to regulation of heat. The hen's bodily heat does not vary much, to which fact her success is mostly due.

The brooder should be heated to a temperature of 90 degrees to 95 degrees Fah. before the chickens are put in. This temperature should be taken with the bulb of the thermometer on a level with where the chickens' backs will be. This rule should be observed always in brooding—"Where the chickens' backs will be." It is not desirable that the chickens should heat

the brooder, but *vice versa*. At the first, their being in the brooder will not make any difference, but gradually an excess of heat of, say, 7 degrees to 15 degrees Fah., will be noticed; it is as well to allow this to remain, so long as they have a chance to move to a cooler part if they want to.

Now the full time for which it is necessary to supply artificial heat is, roughly, five weeks in summer and seven weeks in winter. This is while the feathers are growing. The usual practice is to reduce the heat supplied by 5 degrees Fah. per week; then at the end of the time mentioned the chickens can stand shifting to a warm shed, or a box in an open shed, and find an average temperature there of about the same degree. Of course, the locality must be the guide in this matter; on the coast the writer has deprived chickens of artificial heat after the third week, but a risk is run of their being put back in their growth by a chill.

There are many kinds of brooders with their particular merits, ranging in price from the one to hold a few chickens at 30s. each, up to the brooders for large hatches at about £5 each. Many people build their own, to their satisfaction.

The pipe system is generally used on large plants. This is simply hot water pipes running over the space required, with a fire at one end to heat the necessary water reservoir. Hovers (cloths) are put over the pipes in each division to keep in the heat, and the space is divided by board walls and wire-netting as required. The pipes are generally low at the end where the youngest birds are put, and at a higher level for the older chickens. It is one of the simplest and cheapest forms of brooding, and from the writer's experience well worthy of a trial by anyone who has a boiler or other heating apparatus going constantly.

Incubator chickens may be given to sitting hens, but in this, as in many other matters, much depends on the hen.

The use of incubators and brooders, however, is not advocated for farmers on mixed farms. In the writer's experience the necessary time for best results cannot be given. The rule then is: Small flocks and best quality, and let the hen do the hatching and brooding.

Place your brooder in a shed. The writer has never yet found a brooder do entirely satisfactory work in the open. Allow plenty of sunshine, but not too much sun. Whitewash inside often, and sprinkle a little disinfectant inside now and then.

For bedding, use fine sand or gravel for the first, afterwards cockney chaff, leaves, shavings, pineneedles, or anything dry and sweet; but do not use sawdust. Fresh litter should be supplied daily.

In the moving of the chickens from the incubator to the brooder, when the hatch is complete, if they are not near each other the incubator may be carried to the brooder, or a small box or basket, lined with flannel, used to shift the chickens in; but everything must be done to guard against chill. For this reason the empty shells and unhatched eggs should first be removed and the heat in the incubator somewhat reduced. During

transfer of the chicks, if a small cup of water, heated to 98 degrees Fah., is provided, and their bills dipped in same, it will greatly help assimilation of the yolk absorbed by them.

Now as to feeding.—The writer provides food at once. We are often told that chickens need no food for twenty-four to thirty-six hours after they are hatched; but most hatches take at least thirty hours, so by the time they are put in the brooder the earlier hatched chickens require food. The class of food must now be dealt with. It is a very different thing to feeding them with the hen. It is very seldom that two batches give the same results; and many people go to a lot of trouble with the weaklings, providing all sorts of soft food in the hope of bringing them along. Happy is that person who gives one feed and sticks to that, prepared to accept the average results, and not always trying to go one better. During brooding, feeding might be divided into three periods:—(1) The first four to nine days, when such foods as oatmeal, breadcrumbs, &c., are fed, and when it is harmful to give any meat food; (2) the first three weeks, during which all grain food supplied is best ground; (3) there to four months, which is the time of most growth. During this period food should be supplied at least three times a day.

The first stage is whilst that portion of the yolk of the egg which was absorbed into the system is assimilated; nine days is the full time, but in many cases, finely-ground grains are supplied earlier, say on the fourth day. Coarse oatmeal (not rolled oats) and stale bread, browned in the oven and crumbled, in equal parts, is supplied at Wagga Experiment Farm with good results from the start. There are advocates for feeding the yolk of hard-boiled egg mixed with bread crumbs, but the objection arises as to the digestibility of this food. The egg is sometimes "scrambled," but foods of this sort are sloppy in a brooder, and more likely to be trodden into a hard mass than eaten—unless the chicks can be prevailed upon to eat out of a covered-in tin, which is difficult for the first few days. In large plants, of which the writer has had some experience, prepared chicken mixture is fed from the first with excellent average results, besides being a great time-saver.

Fresh milk or separated curds and whey may be supplied, either as a drink or by soaking bread in milk and squeezing dry—curds by themselves. All are very good foods, but their liability to sour if spilt or left about necessitates caution.

Green food in the earlier stages should be soft and young, as well as finely cut.

If a mill is owned, home products may be ground and used when grain feed is commenced. A good mixture is—wheat, 20 parts; maize, 10 parts; oatmeal, 5 parts; ground china or some hard grit, 1 part; shell of some kind, 1 part; and a small proportion of fine pieces of wood charcoal. Many other small seeds may be added with advantage, if available, in small quantities —such as hemp seed, millet, canary, and linseed. Full wheat may be safely fed after the third week, commencing in small quantities; corn, oats, and barley should still be ground.

Vegetables, well boiled and mashed, are a valuable addition to the food at all times.

Meat foods of all kinds are best withheld till after the ninth day, then they may be supplied up to a small quantity daily.

The number of times to feed daily is practically governed by what is necessary. At first possibly every hour or so, as when young they need some low dish to eat out of, and the food must be kept clean and sweet; therefore supply small quantities often. Later, use covered-in troughs and self-feeding boxes, where the food may be available at all times.

Water or milk should be supplied in covered-in tins, and kept clean and cool. Change twice daily at least.

Deaths result from overcrowding. About sixty chickens, of same age, are the most that will do well together. Putting lots together, even though only a few days different in age, is a bad practice, though often unavoidable.

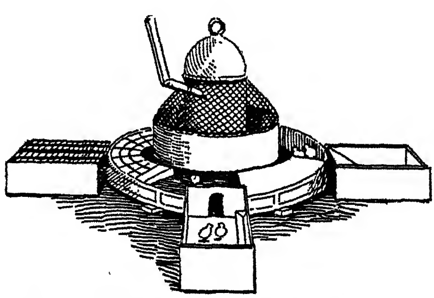
Trampling of the weaker ones occurs in many hatches. To prevent this, where the heat is not well spread over the sleeping quarters, a circle of fine mesh wire-netting or perforated zinc about 1 foot in diameter around the lamp is valuable—it spreads the chickens, and also provides ventilation.

A common bowel trouble is White Diarrhœa. It is a danger signal that the food is unsuitable, or that the bowels are weak from chill or over heating, or hereditary influence. Feed only dry food and put a pinch of Bi-carbonate of Soda in drinking water. Incubators should be disinfected.

Pasting of the vent occurs from the bowels not being in a proper state to fully eject the excrement. It also happens through the chickens backing up against the heater. The best remedy is to gently pull off the adhering mass—this is the hen's method. A small dose of Nux vomica, about ¼ to ½ drop to a chicken, given in the drinking water will prevent recurrence.

These are most of the earlier troubles. Most other diseases are those to which adult fowls are also subject.

Separating the young roosters and pullets should be done at from seven to eight weeks old for lighter breeds, and nine to ten for the heavier breeds for best results.



Réaumur's Hatching and Rearing Apparatus, about 1740.
From an old work.

The Strawberry.

W. J. ALLEN.

Owing to the great demand for good strawberries in and around Sydney, I have had frequent inquiries as to the soils best adapted to their growth, how the land should be prepared, and care of plants after setting out. During the last year or two there has been a considerable increase in the area under strawberry cultivation; yet, notwithstanding this fact, at the present time, while this fruit is at its cheapest on the Sydney market, it is so dear as to make it prohibitory almost for the economical housekeeper to use it in the fresh state, to say nothing of making it into jam or preserve of any kind for winter use. This is all wrong, and shows a lamentable want of energy or enterprise on the part of the small fruit-growers or market-gardeners, as, with such a market as Sydney at their doors, there is a large and ever-increasing demand for this fruit. In nine-tenths of the country towns I have visited, either through lack of moisture or a spirit of apathy on the part of the fruit-growers and gardeners, I have found that few, if indeed any, strawberries are obtainable, and this during the season when they should be most plentiful. I am quite aware of the fact that in dry districts it is impossible to grow paying crops without water; but there are many localities where a sufficient supply can be had, and where strawberry growing could be made a paying industry, and there is plenty of room left yet for all of our growers to enlarge their beds, and, if they will grow good fruit, still find a ready sale for it.

Early berries as a rule bring the highest prices, but the medium and late, if of good size, quality, and deeply coloured before being gathered, are also very profitable.

The packing and grading of the fruit must not be neglected. This important factor in the realisation of high prices has, as yet, received very little attention, many growers considering it a waste of time; but if they would take the trouble to look into the windows of the fruit-shops, where all fruits are seen classed in different sizes, one would imagine that their first thought would be, "Why, what an improvement this careful grading and packing makes in the general appearance of the fruit; in future I will see that my fruit is arranged properly in the cases, and so get the top price for it!" I am sure that when once they do this they will never again relapse into the old slipshod method.

Situation.

In Canada, where I have picked wild strawberries of the very best flavour, and where this berry is indigenous, it never grows in hollows, or where the water lodges, but is found growing on knolls, or ground through which the water passes freely, and doing especially well on soil which has

been enriched by fallen leaves and decaying vegetation. In this respect, we cannot do better than follow nature's teaching, by choosing high and dry land. Boggy or swampy spots should be avoided, unless drainage is provided. In this way, most excellent strawberry ground may sometimes be obtained. Strawberries are always most highly flavoured when grown in the sun, and the bed should be so situated that it will get every ray of light from sunrise to sunset, berries ripening in the shade being indifferent in quality and lacking in colour and flavour. Shelter is good in bleak exposed places, to break the violence of the wind, and prevent injury to the fruit and foliage. Deep-rooted, and not surface-rooted, trees should be chosen for break-winds around orchards or gardens; and last, but not least, the bed should be so situated that water can be applied when necessary. Localities where late frosts are frequent should be avoided.

Soil.

The strawberry belongs to the natural order of *Rosaceæ*, and is known botanically as *Fragaria*—from the Latin *fragrans* (fragrant). It may be grown successfully in any soil which will produce good crops of corn or potatoes. To be most productive, however, the soil must be well drained, deeply worked, either by subsoiling or trenching, and well enriched with manure. It is true, good crops may be obtained without trenching, but not in such excellence, profusion, or certainty in all seasons. Taken as a whole, the very best soil, and the one best adapted to the largest number of varieties, is a deep sandy loam. Certainly a rich clay loam, with a good under-draining, will give as large a yield, but the fruit will not ripen as early as in the sandy loam. Avoid, if possible, a stiff heavy clay.

Preparing the Soil.

If the land has not been fallowed the year previous to being planted, it is important that crops should have been grown which required clean culture, such as corn, potatoes, and garden crops, as they are of great advantage in putting the land in good condition, and freeing it from weed seeds. Cowpeas, however, when grown and turned under, answer the same purpose, and add plant-food to the soil. The soil should be well drained to a depth of 2 or 3 feet, and ploughed and subsoiled at least 15 inches deep. If the subsoil is poor, it should only be stirred, but not brought to the surface; in any case, the land should be well worked, and enriched to a depth of at least 15 inches in the spring, then as previously stated, either fallowed or planted with vegetables which admit of being removed before the preparation and planting of the strawberry in the autumn. The root of the strawberry will extend as far down as the soil has been prepared and enriched, and the yield will be abundant in proportion. Land deeply prepared and heavily manured retains the moisture so essential to strawberry culture, and enables the plants to produce the greatest quantity of fruit.

Propagation.

Propagation may be effected by seeds, runners, and division of the plants. Seed is rarely used, and only for raising new varieties. The seed should be

saved from the finest berries, and must be fully ripe when gathered. The berries should be squeezed by hand in water, and the seeds which are on the surface of the pulp will, when detached from the skin, sink to the bottom. After several washings, to remove as much of the pulp as possible, the whole should be strained through a cloth and dried.

Seed should be sown in the autumn or spring, in light, rich, open soil. It is best to sow in boxes or pots, so that more care can be given than in the open ground. When the young plants have made four leaves they should be transplanted, about 3 inches apart, into small beds. The following season they will be ready for the plantation.

Plants are so freely produced by runners, in the case of most of the varieties, that no other method of propagation is needed, the best plants being those first formed on the runners.

Never use old plants which have been divided up, if young ones are procurable.

No plant needs more care in transplanting. The crown should be on a level with the soil, the roots spread fan-shaped when setting, and the earth well firmed around them. The runners should be well rooted by February, at which season I would recommend planting, wherever there is sufficient moisture, as the roots will get a good hold of the ground the same fall, and by the following summer make fine strong plants ready to begin bearing. If the season is dry the plants may be set in March and early April. Figure 1 shows roots well spread, fan-shaped, and crown on a level with the

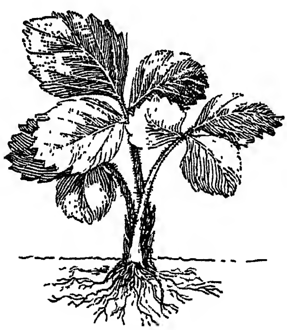


Fig. 1.

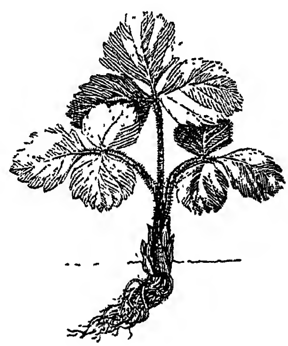


Fig. 2.

ground. Figure 2 shows roots matted together and crown below ground; this plant will rot off in the crown and die. Matted roots never make such vigorous growth, even when planted at a proper depth.

The following are the number of plants to the acre, at the distances mentioned:—

2 ft. x 1 ft. ...	= 21,780	3 ft. x 1 ft. 6 in.	= 9,680
2 ft. x 1 ft. 6 in.	= 14,520	4 ft. x 1 ft. ...	= 10,890
2 ft. x 2 ft. ...	= 10,890	4 ft. x 1 ft. 6 in.	= 7,260
3 ft. x 1 ft. ...	= 14,520		

Cultivation.

Too much attention cannot be given to cultivation. As soon as the plants are set out the work must commence; after planting, cultivate all the ground well, and hoe around the young plants. If the season be a dry one, cultivate once a week; if moist, the plough may be used to turn light furrows, but care must be exercised not to cover the young plants while ploughing. Immediately after ploughing, run a fine-tooth cultivator over to keep the soil from baking, and also to keep a nice fine surface which will retain the moisture. A good mulch applied at the time of fruiting will always be found very beneficial, as it helps to retain the moisture, and keeps the berries from coming in contact with the soil, and becoming gritty and dirty. As soon as the fruit has been gathered remove the mulch, give the soil between the rows thorough cultivation, thin out, or allow only such young plants as are required to remain, and mulch the second winter in the same way as the first. Weeds must not be allowed to grow at any time. To obtain best results, beds should be renewed every two years.

Planting.

The land should be in a good state of tilth, having, as previously recommended, been thoroughly worked to receive the young plants. If the intending planter has not raised the plants himself he should procure them from a successful grower, and see that the parent plants are strong, fruitful, and free from diseases. Distance of setting depends upon the character of the soil, freedom with which the variety selected sends out runners, &c. In such soils the rows should be from 3 to 4 feet apart, and the plants 18 inches apart in the row. Compactly growing varieties may be planted a little closer. This is called "hill" culture, and consists of growing each plant by itself in a hill, not allowing the runners to grow; consequently each plant becomes stalwart and large, and when properly attended to produces the very finest fruits.

Matted Rows.—This system is generally adopted by large growers, as it requires less labour to attend to a large area. By the matted row system more berries are produced on an acre than by the hill culture, but the latter method gives larger and finer berries. The rows are set from 3 to 4 feet apart, and about 15 inches apart in the row. When the runners start they may be so arranged that they form a continuous matted row. The grower can suit himself as to how wide he allows the row to run. Some allow the rows to become 2 feet wide, and others only 1, according to the distance apart the rows have been set. The runners can be kept in check after the row has attained the desired width by using a roller cutter, running up and down between the rows, or by the use of the spade or hoe.

Before planting the new plant all dead leaves and runners should be removed, and the roots shortened by at least one-third of their length.

Manuring.

In the case of tree-fruits, slowly-available forms of plant-food or manure answer quite as well, and in many cases better, than the more active forms, since it is needed in small amounts through a longer period. With strawberries the conditions are much different; the time of development of both plant and fruit is short, and hence the fertilising material should be quickly available in order to fully supply the demand for rapid growth and development. A thoroughly well-rotted manure is a good fertiliser. Soot may also be applied in spring in the proportion of 40 bushels to the acre. A good autumn dressing is equal parts of bone-meal and kainit—say, 3 lb. to the square rod. Nitrate of soda is particularly valuable on light and calcareous soils; it should be applied during the growing season in spring—about 200 lb. to the acre—and should be powdered and kept from the crowns. Wood ashes and ground bones give fairly good results when the soil is rich in humus. The commercial fertilisers are found more beneficial where the strawberries are grown in rich gardens, but where field culture is pursued they are not so valuable as good heavy dressings of well-rotted barn-yard manure. In soils where there is a deficiency of lime, the superphosphate of lime, at the rate of about 2 cwt. per acre, will not only be a good fertiliser, but will help to keep down insects of various kinds.

Pruning.

The strawberry, like other plants, requires to be pruned in order to obtain the best results. As stated previously, when planting, all dead and withered leaves are removed, and the roots shortened to about one-third of their length. When the first two hoeings are given, it is advisable to pull off all runners and all blossoms from autumn-planted strawberries until the spring; while all blossoms should be picked off spring-planted berries until the plantation is well established, when runners are only permitted in such cases as they are required for propagating purposes.

Irrigation.

It is impossible to grow strawberries to perfection without plenty of water. In some districts there may be sufficient rain to mature them properly, which is the best method, as the plants and berries do not come in contact with the water; but, I fear, few places in New South Wales are so blessed. When the soil becomes at all dry, the beds should receive a thorough soaking, either by flooding or running the water through furrows previously made for the purpose. If flooding is intended, the vine should be planted on slight ridges, so that the crown of the plant shall not be under water for any length of time. On no account should the soil be allowed to become hard or caked after applying water. If the surface is covered with a mulch this will keep the soil free; but if there is nothing on the bed, shallow cultivation must follow immediately the ground is dry enough for working. I would recommend keeping the beds covered with a mulch during the dry and fruiting seasons.

Perfect and Imperfect Blooming Varieties.

The blossoms of the strawberry are divided into two classes—1st, bisexual or perfect, and 2nd, pistillate or imperfect. The former contain stamens or male organs and pistils or female organs, as shown in Fig. 4—hence are called bisexual or perfect; while the latter contain pistils or female organs only, as shown in Fig. 3. It is, therefore, well for the beginner to ascertain which are perfect and which imperfect before planting, in order that his plantation may not be limited to imperfect kinds. Some seasons one row of a perfect

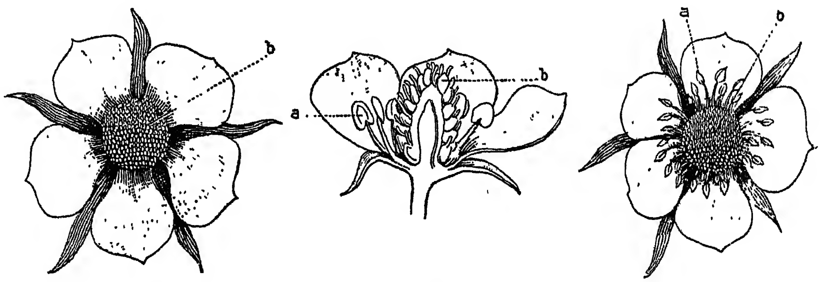


Fig. 3. Fig. 4*a*.

Fig. 3 showing imperfect flower, with (*b*) female organs only; Fig. 4, showing perfect flower, with (*a*) male organs and (*b*) female organs; Fig 4*a*, vertical section of perfect flower. (After Jensen.)

blooming variety will furnish sufficient pollen for six or eight rows of imperfect bloomers, but it will not do so every season, and when it does not, small rough berries are produced. More than one variety should be planted in the field to furnish the pollen, and these should bloom at different seasons, so that early, medium, and late varieties may be properly fertilised. It is well known that pistillate varieties, when properly fertilised, yield the largest crops of fruit; but when varieties are planted as fertilisers, they should be of a kind producing berries of about the same size as do the imperfect blooming varieties.

To ensure a due proportion of plants bearing perfect blossoms, careful nurserymen usually select strawberry plants indiscriminately. Thus a purchaser may obtain among a selection of fine vigorous rootlings some plants that appear to be inferior, but are, nevertheless, necessary.

Varieties.

There are a great number of varieties of strawberries in cultivation. Most of them have some special point worthy of consideration, but it is only by experimenting, by selection and keeping in touch with what other growers are doing, that we are guided in deciding what varieties to grow. In choosing kinds for home use it is well to include a sufficient number to provide a succession throughout the season, and, therefore, as the fruit is not intended for market, the quality of firmness may be sacrificed to that of flavour. Fruit of regular form, medium to large sized and well coloured, is always most sought

after, whether for home use or market. A first-class strawberry should embody the following characteristics:—

Fruit large, of regular form and uniform, texture fine, flesh rich and firm, with a moderate amount of acid and with an aromatic flavour. A longitudinal cut should show no hollow space. The seeds should be deeply imbedded and the calyx set high so as to be easily detached. The plant should be hardy, vigorous, and strong, with perfect flowers, *i.e.*, self-fertilising, a prolific bearer, with stalks of sufficient length to keep the fruit out of the dirt.

The following list comprises those varieties which at the present time are mostly grown for the best paying results:—

Aurie.—A Queensland strawberry, valuable for its extreme earliness, great productiveness, and robustness. It arrives in Sydney early in July. The fruit is a great favourite in the Sydney market, not only for its size but also

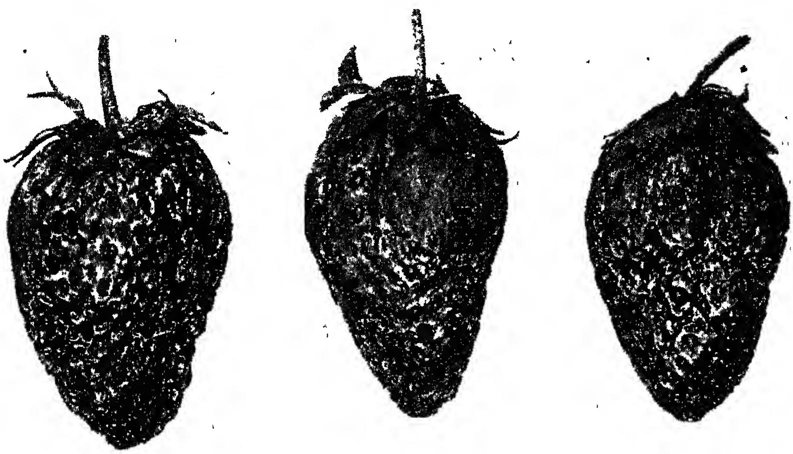


Fig. 5.—Aurie.

its delicious flavour. It is large, uneven, red in colour, glossy, the plant healthy, roots long and abundant, penetrating the soil deeply and withstanding the drought well.

Annetta.—A Queensland variety, heavy and constant cropper, with plenty of foliage to protect the fruit.

Royal Sovereign.—An English variety belonging to the British Queen section. Fruit very large, oblong, conical; colour a bright, glossy scarlet, and ripens early. Flesh firm, juicy, with a rich flavour similar to that of the British Queen. Plants strong and very prolific.

Captain.—One of the very hardiest varieties, and particularly good for dry districts; will withstand the drought when others fail. Fruit large, ovate and regular, of splendid flavour. A very prolific bearer. Ripens early. Skin pale red, flesh pale, firm, with a brisk, pleasant flavour.

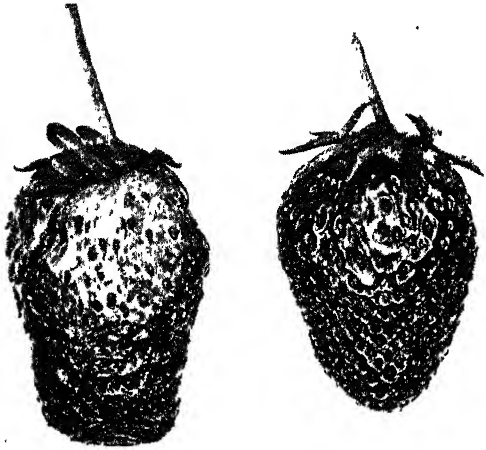


Fig. 6.—British Queen.

Noble (Laxton's).—One of the largest strawberries in cultivation. Heavy cropper, but no good for shipping. Rather soft, and bruises.

Sunbeam.—A hardy plant; fruit of medium size and good flavour. Plants shade fruit well.

Melba.—Fruit large, brilliant red, and of the best flavour. It will bear good crops from beginning of November to May. One of the most profitable to grow. Runners can be left, and start bearing as soon as rooted, making a solid bed.

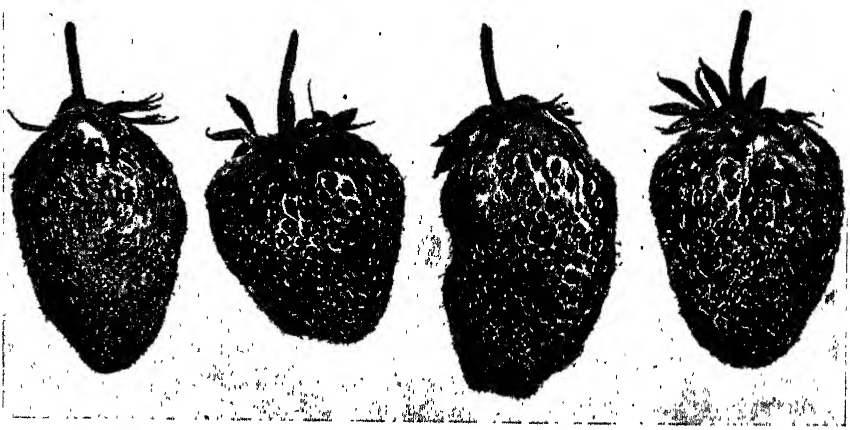


Fig. 7.—Creswell's Seedling.

Creswell's Seedling.—An excellent, hardy variety, free from disease. Good cropper.

Trollope's Victoria.—A recently introduced English variety, and one of the best for most parts of New South Wales. Fruit large, roundish, ovate, and regular in outline; skin deep bright red; flesh pale red, tender, juicy, with a pleasant, slightly sub-acid flavour; plant vigorous, and bears freely and regularly, and can be depended on more than any other kind, as it will adapt itself well to various soils; it ripens early and comes in immediately after "Edith" and "Marguerite."

Edith.—An excellent and very popular variety. The fruit is large, well coloured, and has a rich, pleasant, slightly sub-acid flavour; plant strong, very hardy, and prolific, and can always be depended upon for a crop; it can be grown successfully in most soils and situations, and comes in very early, the fruit of this variety being one of the first in the market.

Marguerite.—A well-known and popular variety, with very large conical or cockscomb-shaped fruit which ripens very early; skin bright shining red; flesh white, tinged with pink, firm, moderately juicy and sweet, but lacking a high flavour; plant robust, hardy, and bears freely. This is a favourite kind, on account of its earliness and also because the fruit, being firm, carries well.

Sir Joseph Paxton.—An excellent early English variety, with large roundish berries; skin bright glossy red; flesh pale red, firm, rich, and highly flavoured; plant strong and productive.

King Edward VII.—Result of systematic hybridizing of Royal Sovereign, and raiser claims to have produced a far superior berry; fruit extra large, deep vermilion, produced in bunches, well clear of the ground. Heavy and constant cropper, bearing from September to May; in fact, it is almost an all-the-year-round strawberry. Flesh pure white, delicious pineapple flavour. Cannot be too highly recommended.

Dr. Moree.—Raiser's description:—"A splendid berry of the Creswell type, but larger, better flavoured, and a heavier cropper. Last spring I counted over 200 formed berries (not counting blossoms) on one plant, and this same plant has fruited continuously ever since, and now (March) has a good show of blossoms, green and ripe fruit. This is not an exceptional case, but simply one of many plants in the bed which I marked for identification."

Picking and Marketing.

The state of maturity at which strawberries can best be picked depends upon the market for which they are intended. Berries for local markets can be gathered in a much riper condition than fruit intended for shipping long distances. For Interstate markets strawberries must be gathered as soon as fully grown and the colour well developed. The fruit is picked with stems on, into quart baskets or boxes, and carried to the packing shed on trays holding from 6 to 12 quarts. Good pickers can do all the sorting and grading necessary as they gather the fruit. All small, inferior, and over-ripe berries should (under all circumstances) be rejected. Pickers can also

face each basket, thereby increasing the attractiveness of the package. This is easily done while picking by placing the last layer of berries stem end down.

Berries should never be allowed to stand in the sun before being packed in the crates. The fruit should be gathered either in the early morning or in the cool of the evening, and not while heated with the sun. Care should be taken not to pick while damp, and the fruit should not be handled any more than is necessary, as, being tender, it is easily injured.

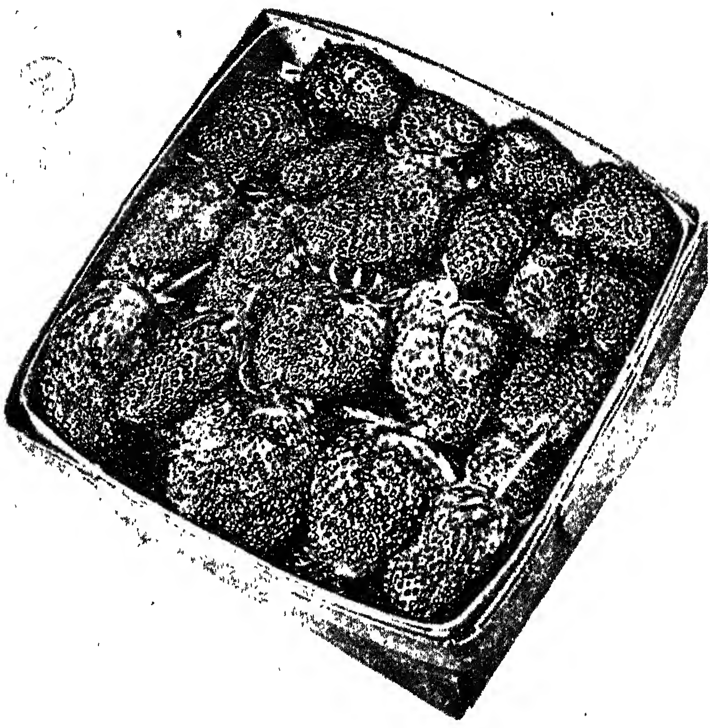


Fig. 8.—Creswell's Seedling.

The practice of branding each crate of fruit with the grower's name, and the variety, in a neat design, is an excellent idea adopted by some growers. This is an inexpensive form of advertising, and helps to create a demand for a grower's product if his fruit is uniformly good and carefully picked.

Diseases.

Leaf-blight, Rust, Sunburn, and Mildew are the most troublesome diseases with which we have to contend. The attacks of the fungus diseases appear at any time during the growing season, the first symptom being the formation

of small purple spots, which gradually increase in size until they are from an eighth to a quarter of an inch in diameter. These spots change to a clear reddish-brown, and become still lighter as the season advances, in some cases the entire leaf being so involved that it withers and falls off, thus denuding the plant of its foliage at the season when it is most required, and in many cases lessening the crop. The fungus is carried over winter by means of spores and by mycelia (representing the vegetative portion of the parasite). Some varieties are affected much more than others, and often to a greater extent on sandy than on clay loam.

Treatment.—Spray the plants with Bordeaux mixture as soon as they commence growing in the spring, and follow this by a second spraying when the blossoms open. After the fruit is harvested remove and destroy all old foliage; then spray the new growth at intervals of three weeks until two or three applications have been made.

Mildew appears on the berries as well as on the surface of the leaves during the summer, the latter curling up and having the appearance of suffering from want of water. This disease, however, is rarely serious.

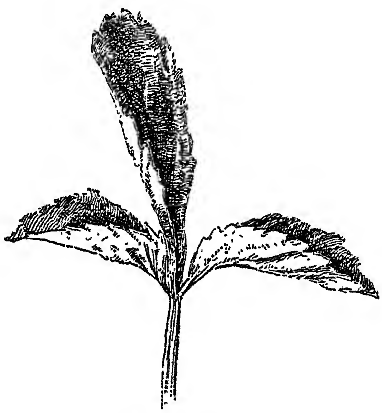


Fig. 9.—Mildew.

Treatment.—Sulphur, if scattered over the leaves and between the plants, will generally suffice to keep this in check, the fumes given off under the action of the sun's rays having a preventive action upon the growth of this fungus.

Strawberries are frequently attacked by minute flies, varying in colour from green to brown, black, and white. They appear at different seasons and cluster thickly on the plants, from which they extract the juice and close up the pores with their excreta. A spraying with strong tobacco-water, or soft-soap and kerosene, will be found very effective.

If caterpillars are troublesome, which they sometimes are in the early part of summer, dust the plants frequently with finely-powdered lime and soot. Soot is more lasting in its effects than lime. If weevils or beetles make their appearance, work the ground well, also dusting a little lime over the plants and ground.

Summary.

There is no fruit which will return a greater income for time and money expended than the strawberry.

While good varieties are of great importance to the grower, they are little better than poor kinds unless they receive proper cultivation, which is essential to success.

Be sure and see that the plants have plenty of water during the fruiting season. In our hotter districts a watering once in a fortnight would not be too much, but great care must be taken not to submerge the plant or berries.

Pistillate plants usually bear the largest fruit, but perfect blooming varieties must be planted close by for fertilisation and crops of fruit.

The soil should be stirred after every shower when the beds are not mulched.

The best berry is that which possesses attractive appearance, good size and flavour, and is a good shipper.

In marketing fruit, see that it is packed neatly in chip-baskets, holding from 1 lb. to 3 lb., or other neat packages.

When choosing varieties, always choose vigorous plants of such kinds as have been most productive in your particular locality, and which are as free as possible from disease.

Most growers find it profitable to fruit their beds for two or three years.

Failure to get a maximum crop frequently arises from improper fertilisation.

The culture is the same for berries for both home use and the market.

It would be well to give more attention to intense cultivation, as there are but few crops that offer greater inducements in this direction than the strawberry.

It is the remarkably early and remarkably late crops that return the greatest profit in strawberry culture.

Grading the fruit for market pays with the strawberry as well as other crops.

General Values of Soil Ingredients.

The mineral constituents of plants vary considerably, but rarely exceed 2 per cent., being generally about 1 per cent. of the total composition of the plant. These mineral constituents are extracted from the soil, and comprise iron, lime, magnesia, potash, soda, and perhaps small quantities of other metals, combined with sulphuric, hydrochloric, and phosphoric acids, together with nitrogen. But small as is the quantity of these ingredients, they are as essential to plant life and growth as the materials present in larger quantities (derived from air and water), and if any of them required by the particular plant is deficient, the plant must suffer accordingly.

Of the mineral ingredients, the greater portion are found in all soils in more than sufficient quantities, and, generally speaking, the only ingredients in which a soil is likely to be deficient are lime, potash, phosphoric acid, and nitrogen. When any of these is wanting, it is the function of manure to supply it.

These principles explain why it is that soils are examined by chemists for the abundance or deficiency of Lime (CaO), Potash (K_2O), Phosphoric acid (P_2O_5), and Nitrogen (N), in a form readily available as plant food. Standards have been established of the percentages of these ingredients which are required for ordinary crops, and by these standards it is easy, when a soil is analysed, to see wherein it may be deficient; but when it is remembered that other considerations, such as temperature, rainfall, and market requirements, considerably affect the classes of crops grown, and the time during which they occupy the ground, it will be seen why these standards should vary considerably in different countries.

The following are the figures adopted by Mr. F. B. Guthrie, Chemist of the Department of Agriculture of New South South Wales, showing the value attributed to the percentages of each of the four ingredients present in a particular soil, and soluble in hydrochloric acid:—

Lime (CaO).

Below ·05 ...	... Bad.
·05 to ·08 ...	... Indifferent.
·08 to ·10 ...	... Fair.
·10 to ·50 ...	... Satisfactory.
·50 to 1·00 ...	... Good.
Above 1·00 ...	... Very good.

Phosphoric Acid (P_2O_5).

Below ·03 ...	... Bad.
·03 to ·05 ...	... Indifferent.
·05 to ·10 ...	... Fair.
·10 to ·20 ...	... Satisfactory.
·20 to ·45 ...	... Good.
·45 to ·75 ...	... Very good.
Above ·75 ...	... Excellent.

Potash (K_2O).

Below ·03 ...	... Bad.
·03 to ·05 ...	... Indifferent.
·05 to ·10 ...	... Fair.
·10 to ·20 ...	... Satisfactory.
·20 to ·45 ...	... Good.
·45 to ·75 ...	... Very good.
Above ·75 ...	... Excellent.

Nitrogen (N).

Below ·05 ...	... Deficient.
·05 to ·10 ...	... Fair.
·10 to ·15 ...	... Satisfactory.
·15 to ·40 ...	... Good.
·40 to ·60 ...	... Very good.
Above ·60 ...	... Excellent.

An interesting comparison is afforded by the following valuation of German soils, by Maercker, of Halle:—

Grades of Soil.	Nitrogen, per cent.	Lime (clay soils), per cent.	Potash, per cent.	Phosphoric Acid, per cent.
Poor	Below 0·05	Below 0·10	Below 0·05	Below 0·05
Medium	0·05–0·10	0·10–0·25	0·05–0·15	0·05–0·10
Normal	0·10–0·15	0·25–0·50	0·15–0·25	0·10–0·15
Good	0·15–0·25	0·50–1·00	0·25–0·40	0·15–0·25
Rich...	Above 0·25	Above 1·00	Above 0·40	Above 0·25

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ..	Pansy Duke ...	Earl March ..	Pansy 4th ...	Meerschaum Vale.	8 June, '10.
" ...	March Pansy ...	Earl March .	Australian Pansy	Grafton Farm ...	*
" ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd	Berry Farm ...	*
Jersey ..	Thessalian II ...	Thessalian ...	Egyptian Princess	Wollongbar Farm.	†
" ..	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
Guernsey ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Rous Mill... ...	5 Sept., '10.
" ..	Prince Edward..	Rose Prince ..	Vivid ...	Casino	24 May, '10.
" ..	Star Prince ...	Calm Prince ...	Vivid ...	Dunoon	3 July, '10.
" ..	Prince Souvia ...	Vivid's Prince .	Souvenir ...	Wollongbar Farm.	*
"	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Alstonville ...	20 Aug., '10.
" ...	Claudius ...	Golden Star II..	Claudia's Pride.	H.A. College, Richmond	*
Red Poll ...	The Judge ...	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
" ...	Royal Prince ..	Curly Prince .	Rosie 5th ...	Grafton Farm ...	*
" ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
" ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
" ..	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ..	Wollongbar Farm.	*
" ..	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A College, Richmond	*
" ...	Dado	Daniel	Dot	H.A. College, Richmond	*
" ...	Dan of the Roses	Daniel of Auchenbrain	Ripple Rose...	" "	*
Kerry	Bratha's Boy ...	Aicme Chin ..	Bratha 4th .	Glen Innes Farm...	†
"	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch	....	.. ..	Grafton Farm ...	*
Holstein ...	Hollander ...	Bosch III ..	Margaretha ..	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 2nd April, 1910.

BULLS FOR SALE

ROYAL AGRICULTURAL SHOW.*

From BERRY STATE STUD FARM.

GUERNSEYS.—Lord Clatford: sired in England by Lord Clatford II, 1814; dam, Clatford Richesse, 6816 (imp.); calved 16th October, 1907; colour, lemon and white; price, £50. **Clatford Richesse is a fine type of dairy cow.**

Simple Simon: sired in England by Suzerain III; dam, Muriel 19th (imp.), 7022; calved 9th May, 1908; colour, lemon and white; price, £50.

King's Jubilee: sired in England by Hayes' Coronation II, 1841; dam, Hayes' Muzette 7th, 6904; calved 25th May, 1908; price, £50.

AYRSHIRE.—Scotland's Hope: sire, Jamie's Ayr; dam, Judica, **from Juliette, by Prince Emerald (imp.);** calved 21st February, 1908; colour, brown and white; price, £15.

JERSEYS.—Jack's Joy: sire, Sir Jack; dam, Rum Omelette II, **from Rum Omelette (imp.), by Golden Lord;** calved 4th June, 1908; colour, whole; price, £30.

Dreadnought: sire, Sir Jack; dam, Lady Kitchener, **from Egyptian Princess (imp.), by Lord Melbourne;** calved 22nd October, 1908; colour, whole; price, £20.

Calceolaria's Lad: calved 6th July, 1907; sire, Melbourne (imp.); dam, Calceolaria (imp.); colour, whole; price, £30.

Berry Melbourne: sire, Melbourne (imp.); dam, Rum Omelette (imp.); calved 23rd August, 1906; colour, whole; price, £50.

HOLSTEINS.—Maastricht: sire, Obbe II; dam, Lady Margaret; calved 26th June, 1908; price, £15.

Count Wittereen: sire, Obbe II; dam, Lolkje Zuyder Zee; calved 27th November, 1908; price, £15.

From HAWKESBURY AGRICULTURAL COLLEGE.

GUERNSEYS.—Duke of Richmond: sire, Prince Milford; dam, Alexandrina 9th, 6399 (imp.); calved 6th June, 1909; colour, lemon, fawn, and white; price, £40.

Prince Milford, sire of Duke of Richmond, is by Rose Prince (imp.), from Flaxy (imp.). Alexandrina 9th, dam of Duke of Richmond, is by Pomegranate (1510), from Alexandrina 2nd (3220), by Benefactor (659), from Alexandrina (3219).

Dante: sire, Prince Milford; dam, Angelica 8th (imp.), 5630; calved 14th July, 1909; colour, fawn and white; price, £40.

Angelica 8th, dam of Dante, is by Captain Powell (1430), from Angelica (749).

WOLLONGBAR EXPERIMENT FARM.

GUERNSEY.—Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909; price, £45.

† **Sky Pilot:** sire, Prince Souvia; dam, Parson's Red Rose II (imp.), 6751, from Parson's Red Rose, 2813, by Gil Blas, 1679; calved 7th May, 1909; colour, lemon and white; price, £50.

† **Admiral du Preel:** sire, The Admiral; dam, Hayes' Lily du Preel IV (imp.), 6903, from Hayes' Lily du Preel III, 6166, by Hayes' Royal, 1674; calved 4th April, 1909; colour, lemon and white; price, £45.

HOLSTEIN.—Dutchman II: sire, Hollander; dam, President's Schot; calved 30th December, 1908; price, £10.

The prices indicated are at the places named, or on rail.

H. C. L. ANDERSON,
Under Secretary.

* These bulls are exhibited at the Sydney Show, which is being held as the April *Gazette* goes to Press. At the conclusion of the Show the animals not sold will be available at the prices named, at Berry and Richmond respectively.

† Applications for these bulls will be held till 21st April. If more than one application be received for any one bull, his disposal will be decided by ballot.

Orchard Notes.

W. J. ALLEN.

April.

Seasonable work in established orchards at this time includes the picking and packing for market, or storing of apples (late) and pears. A few weeks after the fruit is all gathered, the bandages should be taken from the trees, and be either boiled or burnt. Good stout bagging is needed as an effective trap for codlin moth, and the depth as provided in the Regulations under the Fruit Pests Act should be adhered to, and any that answers to that description should be boiled and put away for future use. Thin, old, or rotten bagging should be destroyed at once. The trunks of most trees afford a hiding place for codlin grubs; therefore, places likely to harbour this pest should be examined, and all grubs killed and any rough bark scraped off.

In cases where the grower intends to give his orchard two ploughings, the first should be given as soon as possible, otherwise the land should have a complete rest until the winter ploughing, when all weeds which may have grown will be turned under while green before they seed.

Although, in a good many districts, it is getting rather late to sow crops among the trees, it is, however, best to put them in as early as possible now, rather than miss the season. Lime may be applied in cases where the soil is found to require it, particularly where it is sour, or wherever it is very heavy or sticky. After making the application of lime, see that is well worked into the surface soil.

Those who intend planting out new orchards should get the land cleared and subsoiled as soon as possible, and secure their trees. In planting apple-trees, see that they are all worked on blight-proof stocks, as trees worked on such stocks can be more easily kept free from woolly aphis.

Store apples for winter. Mark trees you wish to re-work. Carry out any improvements. Spray for scales and red mites or fungous diseases before leaves fall.

Bandaging Trees for Codlin Moth.

Mr. O. Brooks, Inspector under the Fruit Pests Act, took particular notice during the last two seasons in the Gosford district of the effect of bandaging with different bags. He found that when apple and other trees were bandaged with pieces of corn bag, double the number of codlin-moth grubs were caught than on trees bandaged with chaff bags, unless the chaff bag was fourfold. Mr. Brooks found this difference to occur even on adjoining trees of the same variety.

Specimens of Fruit.

I have to acknowledge receipt of very fine specimens of apples, pears, and grapes from the following growers:—Messrs. Thomas Hawk, Orange;

J. Feilen, Cooma; M. Mawson, Cooma; and M. H. Pond, Raymond Terrace; all of whom sent a collection of named varieties from their respective orchards. We have also received from growers in different parts of the State many varieties for naming. Most of the latter specimens were submitted without any description of the habit or growth of the trees or any particulars whatever. I would therefore suggest for the guidance of those who wish to submit such specimens in future that they give a full description of the tree, when the fruit ripens, the name (if any) by which the fruit is known in the district, and any other information which may help myself or the orchardists in naming such fruit. A typical specimen should, of course, always be sent, with a stem of average length.

Among Mr. Pond's apples were some very fine specimens of Jonathans and Buncombes, which I should imagine would be two of the best to grow in that district. Apples and pears for naming should be forwarded to the orchardists at either the Bathurst or Wagga Farm, as we have hundreds of varieties there with which to compare specimens.

Experiments for the Destruction of Peach Aphis.

Last year Mr. Luke Gallard, Inspector under the Fruit Pests Act, made some experiments with spraying preparations for the destruction of peach aphis on Mr. J. Connelley's property, "Wyoming," Narara. The materials used were "Scalecide," a proprietary preparation supplied by Messrs. H. W. Peabody and Co., 9, Bridge street, Sydney; "Nikoteen;" kerosene emulsion; and sawdust. Mr. Gallard reported as follows:—

"I used the 'Scalecide' with a strength of about 1 in 25, and it gave real good results. (I also tried it 1 in 30, but the results were not nearly as good.) About three days after the application of the 1 in 25 mixture the trees were perfectly clean. It was rather late when we did the spraying, as the trees had burst into leaf, and I feared it might burn the foliage; but it only just touched the few butt leaves. The good done to the tree by removing the aphis far exceeded the harm done to the foliage.

"The 'Nikoteen' showed equally as good results, but when the prices were worked out according to the strengths used, the 'Scalecide' proved to be a little the cheaper.

"I left two trees as checks right between the two lots sprayed, and they were literally covered with aphis for weeks after the spraying was done.

"We also tried kerosene emulsion, 1 in 10, but it did not kill one-third of the aphis.

"I tried sawdust, but the only effect I noticed from it was that the aphis, in attempting to walk over it, fell to the ground, sawdust and all. This lessened the aphis on the tree for a while, but as soon as they recovered themselves they crawled up the tree again and were as bad as ever."

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Gundagai P. and A. Society	A. Elworthy	April 5, 6
Walcha P. and A. Association	J. New Campbell	,, 5, 6
Adaminaby P. and A. Association	W. Delaney	,, 6, 7
Bathurst A., H., and P. Association	A. H. Newsham	,, 6, 7, 8
Bowra A. Association	C. Moseley	,, 7, 8
Orange A. and P. Association	W. Tanner	,, 13, 14, 15
Richmond River A., H., and P. Society (Casino)	W. S. Rayner	,, 14, 15
Upper Manning A. and H. Association (Wingham)	D. Stewart, jun.	,, 14, 15
Luddenham A. and H. Society	W. Booth	,, 14, 15
Moree P. and A. Society	D. E. Kirkby	,, 19, 20, 21
Narrabri P., A., and H. Association	W. Malane	,, 19, 20, 21
Hunter River A. and H. Association (West Maitland)	C. J. H. King	,, 19, 20, 21
Wellington P., A., and H. Society	A. E. Rotton	,, 20, 21
Clarence P. and A. Society	T. T. Bawden	,, 20, 21, 22
Macleay A., H., and I. Association (Kempsey)	E. Weeks	,, 20, 21, 22
Lower Clarence A. Society (Maclean)	F. W. Collison	,, 26, 27
Dubbo P., A., and H. Association	F. Weston	,, 27, 28
Durham A. and H. Association	Chas. E. Grant	,, 27, 28
Coonamble P. and A. Association	J. M. Rees	May 3, 4, 5
Cobar P. and A. Association	D. H. Dunlop	,, 4, 5
Hawkesbury District A. Association (Windsor)	H. S. Johnston	,, 5, 6, 7
Warren P. and A. Association	A. C. Tompson	,, 11, 12
Merriwa A. and P. Association	V. Budden	,, 17, 18
Nyngan and District P. and A. Association	R. H. A. Lyne	,, 18, 19
Walgett P. and A. Association	S. E. Johnston	,, 18, 19
Deniliquin P. and A. Society	L. Harrison	July 21, 22
Hay P. and A. Association	G. S. Camden	,, 26, 27
Riverina P. and A. Society (Jerilderie)	W. Elliott	,, 26, 27
Narrandera P. and A. Association	W. T. Lynch	Aug. 3, 4
Corowa P., A., and H. Society	J. D. Fraser	,, 16, 17
Coolamon A. and P. Association	J. W. Skien	,, 17
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 23, 24, 25
Murrumbidgee P. and A. Association	A. F. D. White	,, 23, 24, 25
Parkes P., A., and H. Association	G. W. Seaborn	,, 24, 25
Wyalong District P., A., H., and I. Association	T. A. Smith	,, 30, 31
Junee P., A., and I. Association	T. C. Humphrys	,, 31, Sept. 1
Young P. and A. Association	G. S. Whiteman	Sept. 6, 7, 8
Ariah Park P., A., H., and I. Association	A. T. White	,, 7
Germanton P., A., and H. Society	J. S. Stewart	,, 7, 8
Albury and Border P., A., and H. Society	W. I. Johnson	,, 13, 14, 15
Ganmain A. and P. Association	J. H. Ashwood	,, 14
Cootamundra A., P., H., and I. Association	T. Williams	,, 15, 16
Temora P., A., H., and I. Association	John Clark	,, 20, 21, 22
Lismore A. and I. Society	T. M. Hewitt	Nov. 16, 17, 18

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VOL. XXI. PART 5. MAY 2, 1910.

Agricultural Gazette of New South Wales.

Sheep and Wool for the Farmers.

[Continued from page 10.]

THE INFLUENCE OF CLIMATE ON BREED.

TYPES FOR LOCALITIES.

J. WRENFORD MATHEWS.

The Early Distribution.

THE widely distributed breeds of sheep with which we are familiar to-day have developed from three or perhaps four primitive varieties. But the steps of their development are uncertain. The Merino is probably the descendant of a long-horned deer-like wild sheep, while the British breeds originated from types domesticated from the very beginning of history. As to how these original varieties became settled in Great Britain, or by what race they were introduced across the Channel, there is no record. Amongst other primitive varieties, they appear to have always remained distinct. and during the process of time have given rise to many types. This exceedingly valuable animal is now to be found in almost every quarter of the globe. It would be impossible to fully estimate its influence on prosperity, on employment, on diet, or even on "the fashions." Of all men's experiments in the animal kingdom, none have been attended with such remarkable success as with sheep. In no country has it made greater progress than in Australia. The discovery of gold did more to develop Australia than any other event, with one exception—that exception was the introduction of sheep by Macarthur. This transplantation is the most remarkable of man's attempts to colonise new lands with flocks or herds available for his use.

The world's prosperity might not unreasonably be stated in terms of the rates ruling in the food and clothing markets of the world. The sheep is of great importance in the former and takes first place in the latter. It has accordingly increased greatly in numbers. Dating from the period of the introduction of sheep into Australia and the other great wool-producing countries of the world, production has increased by the hundred-fold; yet prices so far from showing any decline have steadily advanced. This goes to show that the human race is better fed and better clothed, and must, therefore, be more prosperous to-day than at any other period.

The Improvement of Sheep in Great Britain.

The introduction of sheep into Australia took place at a most opportune time. During the early part of the eighteenth century there lived in England some of the greatest flock-masters the world has ever known. These men aimed at producing the best mutton breeds possible. At that time the English market called for good mutton types. The prosperity of the country resulted in a great demand for mutton by the poorer classes, and even the wealthier, despite their idea that sheep were "poor man's meat," learned to relish the luscious mutton obtained from the early lambs of those improved types. This preference is still more in evidence to-day.

The Work of Bakewell, and other Prominent Breeders.

The foremost of these men, and perhaps the most famous of all breeders, was Bakewell, of Dishley, who effected such a marvellous improvement in the famous Leicester breed, and was really the founder of the improved mutton types. To Bakewell, wool was of little or no interest. His aim was to find the most profitable mutton type, aiming at weight and early maturity. The work of Bakewell and other celebrated breeders of this period on the flocks of England has determined types throughout the world.

After Bakewell one of the most famous was Ellman, with whose name is associated the famous South Down breed. While Bakewell was engaged on a long-wool breed, the work of Ellman was confined to a breed distinct in every particular. His idea for the improvement of this breed was compactness of frame, combined with a symmetrical body developed in every detail to the most perfect degree.

Equally important was the work of the brothers Culley. They were friends of Bakewell, and had the advantage of his wide experience and sagacity. They held that hardiness of constitution was of the utmost importance in any breed, and apparently regarded the Leicester as too delicate and pampered for any but the most favourable country, climate, and diet. As young men they accordingly set themselves the task of evolving a strain possessing a hardier constitution than the Leicester, and yet quite its equal in early maturity. They worked on the English Leicester and the Cheviot. The Leicester was taken as the most perfect type of long-wool mutton sheep; the Cheviot, accustomed as it was to "rough it" in its bleak mountains, they regarded as the hardiest of all breeds. The characteristics of these closely-related breeds were successfully blended into what is known as the Border Leicester.

The sheep industry in Great Britain had, up to the time of these men, been slowly progressing, but it was not until the days of Bakewell, Ellman, and the Culleys that the principles of breeding, defining wool from mutton types, were clearly understood.

Reference might also have been made to the other prominent breeders with whose names are always associated other famous English breeds, and who for the improvement of their breeds have worked with definite objects

in view, but by far the most important work has been accomplished by the men already referred to.

Owing to the profitable nature of the industry and the general expansion of the mutton trade, new breeds sprang rapidly into existence. Moreover, many breeds hitherto neglected began again to attract attention. In the evolution of new types nearly everything was sacrificed to early maturity, the profits depending on getting the young sheep to market as early as possible. This explains the great variety of early-maturing mutton breeds now in existence in Australia, and the keen competition between breeders of rival strains. These breeds have evolved under special local conditions. Our great problem is to find out definitely their usefulness in the diverse climates of the State.

The Lincoln at an Advantage.

At this period the old-established Lincoln, essentially a wool type, was almost entirely neglected. It was allowed to remain as a distinct type, but it is very doubtful whether its true value was ever recognised until Australia came into prominence as a great wool-producing country.

The Lincoln has also filled a very important place in the United States. New Zealand wool-growers for many years favoured the same breed. It was not till the frozen mutton trade assumed the importance that it has done that the Lincoln was largely displaced. But it is in the Argentine, where all the conditions are most favourable to it, that the Lincoln has taken pride of place.

The Transplantation of Wool Types.

Of wool types we have already briefly referred to the Lincoln. The Lincoln thrives best in the colder districts, and under conditions approximating to those of Great Britain. The warmer and drier climate of the great majority of Australian runs, and certainly the largest runs, is rather unsuitable to the Lincoln, a breed of highly domesticated habits; but another wool type—the greatest of all—thrives splendidly in such regions, and stands alone as the wool type *par excellence.* This is the Merino. For centuries it was most jealously guarded by the Spanish nation, and during that time the Spaniards held a monopoly of fine wools, and were celebrated throughout the world for the manufacture of "woollen" goods of the finest texture, made from the wool of those famous sheep. From Spain the Merino was taken into almost every country in which sheep raising was practised. The various strains of Merino do not call for mention here, as it was after their introduction into Australia that the several varieties with which we are familiar here were evolved.

It is the establishment of these two distinct and widely separated wool types, evolved under entirely different circumstances, that enables Australia to offer to the world classes of wool suitable to almost every requirement of manufacture.

While mutton types had been engaging the attention of the English breeders, the flock masters of Australia took up their work on different lines. They soon found out that the natural pastures and climate of Australia were most favourable for the production of wool, and set about to develop the great industry accordingly.

At that time the export of frozen mutton had not been thought of. The sheep farmer or squatter had no alternative but to use such types as would give him some return, however small. Since then, however, other branches of the industry have been developed, and consequently the improved mutton breeds have come into request.

In view of the fact that the first growers aimed solely at wool production, it is a remarkably fortunate circumstance that there have been available those improved mutton breeds necessary to the more recently developed branches of the industry—fine types of English sheep which had taken years to evolve. Equally important is the fact that Merinos began to be exported from Spain just in time to lay the foundations of our great Australian wool flocks. The world's great events seem to take place at opportune times, and the sheep industry of Australia could not have been inaugurated at a more suitable period.

The Development of the Woollen Industry.

No modern industry has expanded like the manufacture of wool, but it is doubtful whether the trade could ever have reached such vast proportions had it not been for the magnificent progress made in the development of the Merino and British breeds in Australia. Thus our wool trade is a great factor, not merely in national, but in international prosperity, and the condition of the sheep industry of Australia has become an indicator of the wealth of the world. While the Merino was confined to Spain, the English manufacturer of that period thought the "woollen" trade incapable of much expansion, owing to the limited supply of the raw material. But, dating from the time when the Merino sheep was successfully established in Australia, not only was the "woollen" trade vastly increased, but the use of Merino wool for the further extension of the "worsted" trade received the greatest attention from manufacturer and inventor alike. This is mainly due to the magnificent length of staple now obtainable from our breeds. For this development in the Merino, Australia takes almost all credit.

No Breeds Indigenous to Australia.

Before discussing the merits of different breeds individually, it is thought necessary to determine with considerable accuracy the conditions under which this highly profitable form of live stock has been introduced into Australia. The connection between type and climate will probably not be evident to those who have not given the great question of breeding the careful thought it deserves. It is our object to lay down on somewhat definite lines the details of this most advanced department of stock raising;

it seems, therefore, very necessary at this stage to have a clearer understanding of the principles underlying this enormous and highly productive industry. It is on the intelligent grasping of such principles that the future of the great question of type depends. The Australian sheep industry is full of romance, and has become so familiar that "every schoolboy knows" who landed the first flock of sheep at Port Jackson; but it is doubtful whether one in ten, even of the older generation, has wondered why the Merino should be confined to certain parts of Australia, while in other districts British breeds may be kept to better advantage. We enjoy a glorious climate, in which sheep may be depastured in the open all the year round. Herbage is produced in abundance on our natural pastures, and these supply all the essential elements for the production of wool of the highest texture and mutton of the most delicious flavour. It is interesting to note the greater progress made by sheep as compared with the other classes of live stock which have been introduced. To maintain type, breeders of horses, cattle, and pigs, have from time to time been compelled to go to the original homes of the breeds for suitable strains to reinvigorate their own. In spite of the old and commonly held opinion that the Merino was peculiar to its own country, we have in a comparatively short time so perfected that breed that instead of Australian flock-masters seeking new blood abroad, other countries now send to Australia for types of Merino, and some of the British breeds as well, to improve their own flocks. No country suits sheep better.

Despite all these natural advantages it seems strange that, as we have already noted, no species of sheep, or in fact of any other domesticated animal, is indigenous to Australia. America, which at one time threatened to outrival Australia in the sheep industry, and where the Merino and the many British breeds have been so largely introduced, can claim the possession of a wild species of sheep. This animal was found in the Rockies. Whether identical with the primitive European and Asiatic varieties is very uncertain, but it is interesting to notice that it has never progressed beyond its original state, while the more recently introduced Merino and British breeds have undergone considerable development.

We shall now proceed to trace how these various breeds have progressed under the diverse climate and varied circumstances of this, their new home.

The Effect of Climate on Type.

New South Wales, and for that matter Australia, presents a wide range of climate, extending from subtropical to cool temperate. It embraces districts with a very high rainfall and a very humid atmosphere, and others which are exceptionally dry. Those districts also vary in altitude from very little above sea level to a height of several thousands of feet. The surface varies from rugged mountain districts, through tablelands and belts of undulating down-like country, to broad expanses of uninterrupted plain. Thus each region has its particular modification as regards rainfall, altitude, and surface, as well as soils and pastures.

The coastal plains possess in general a high rainfall, a rather humid atmosphere, and fertile soils. The tablelands have a colder but still fairly moist climate, with soils on the whole rather less fertile than in other parts of the State. West again is the undulating country, with a temperate climate and still fairly well watered by rainfall and running streams. The plains of the far west are characterised by a climate hot and dry in the extreme, and subject to periodic drought.

Of all classes of live stock none are so susceptible to climatic influence as sheep, and of all sheep none respond to environment more readily or more fully than the Merino. To attempt to describe all the various Merino types to be met with in this State would be beyond the scope of this article, quite useless to the farmer for whom it is primarily intended, and altogether premature at this stage.

So great an influence has climate on the Merino that in each district different sizes and degrees of form may be distinguished as variations, even within the limits of each specific type. Yet we propose to briefly describe a few of the commoner types, in order to explain the far-reaching effect of climate on the Merino. The Merino is dealt with first, not merely because it is the breed most suitable to our arid conditions, and the breed from which we must always derive our main source of wealth, but also because the Merino, crossed with the various British breeds, forms the foundation of all experiments conducted to evolve both wool and mutton types.

The Breed in Other States.

We might profitably, at this stage, digress somewhat to refer briefly to the main types produced by the varied climatic soils and pastures of the widely separated districts of South Australia. That State comprises a long strip of territory, extending almost through the heart of Australia, and so situated geographically that the "Far North" is very near the tropics, while the southern districts border on the cold waters of the Southern Ocean.

There are thus three, or even four, distinct climates in which sheep are kept in South Australia—the Far North and North, extending from the 28th to the 32nd parellel of south latitude, the middle divisions extending from these parts to within a few miles of the capital (Adelaide), and the Southern and South-eastern districts.

Special Types.

The northern belt has produced a Merino type admirably adapted to that situation and that climate. It is, however, within the middle divisions, with their higher rainfall, that the Merino for which the State is famous is produced, and certain sections of these districts have become the nurseries from which the "great outside" is supplied. This breed is described as the largest framed Merino sheep in the world, and one which carries a fleece which, while of a lower spinning quality, is nevertheless a most serviceable class of wool.

These sheep are famous for their large frames and well-developed bodies. They combine the maximum quantity of wool with carcase and constitution, and are most valuable in dry areas.

These ewes are noted for the high percentage of lambs which they rear each year, having large frames and deep bodies, with splendid hind quarters.

The types of Merino as bred in South Australia.

The utility class of Merino. This sheep displays all the true characteristics of the plain-bodied class, a big frame which is well proportioned and evenly developed, a uniform class of fleece with splendid neck development.

This class of ewe is valuable not only for the profitable class of wool which it produces, but also for its usefulness in mating with British breeds. For this purpose it is much sought after by farmers

The types of Merino bred in the Lachlan District, New South Wales.

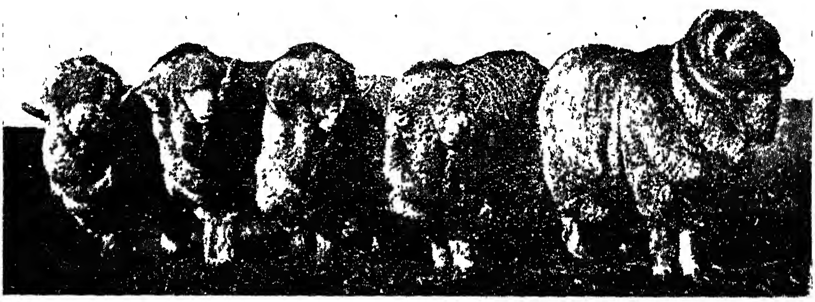
The aim of the northern breeders is to produce a "dual purpose" type of Merino, one combining the maximum elements of wool, carcase and constitution, the two latter being always proportionate in these sheep. The type is remarkably uniform. Is this uniformity due to the efforts of breeders to evolve the most suitable type for the region, or is it the result of climatic influence? The type is undoubtedly the joint result of both breeding and climate. Each grower naturally aims at producing the best and most profitable class of sheep that he possibly can. He carefully notes the peculiarities or "variations" of individual animals, and mates those possessing in the most marked degree the qualities he wishes to cultivate in his flock. This applies more particularly to external features, or those more readily noted. But there are many less obvious variations, as for instance, in constitution, about which he knows little or nothing, and it is in those particulars that Nature has her say and that the influence of environment comes into play to make or mar his flock. The long droughts of a few years back did much to determine special types of Merino, and to ensure the "survival of the fittest." Man, to satisfy his whims or to increase his immediate profits, will often save a "weakling." Nature will always sacrifice the individual to maintain or improve the constitution of the race. Thus there is to-day in the northern areas of South Australia, and to an extent throughout the dry belts of the far west of New South Wales, a type of Merino better fitted to resist drought and endure hardship than ever existed before.

Types Suitable to Localities.

The big-framed, coarse-boned type of Merino referred to can, in virtue of its splendid constitution, travel the long distances often necessary to obtain sufficient food and water for its needs. The type of Merino in the south-east affords a striking contrast to the sheep of the north. While the northern Merino possesses a splendid frame and is of the robust type, its south-eastern relative, living as it does in a cooler and moister climate, is much smaller in conformation and much less hardy in constitution.

The term "constitution" is used to describe the physical condition of sheep of whatever breed or locality. It is just as important that the Merino of the colder districts should possess a good constitution as it is in the case of breeds raised in warmer and drier climates. While the soils and pastures of the warmer and drier climates help mutually to develop the size and general conformation of frame, the type of Merino bred in and acclimatised under colder and damper conditions is better fitted to flourish in the circumstances under which it has to live than a sheep transferred from warmer and drier areas. The big-framed, able-bodied sheep such as we have already described is rendered valuable not only by increase in size of frame, but also because of greater length of staple and the extra quantity of wool thus produced. A smaller type, such as that of the colder districts, although it does not produce so heavy a fleece, is nevertheless a profitable class because of the greater density and consequent high quality of its fleece. Even admitting that

the big-framed sheep by its vigour and robustness has done more towards making wool-growing a profitable industry within extremely dry areas than any other type, yet the magnificent quality of the Merino, produced under less extreme conditions, has made Australia a household word in every manufacturing centre for superfine quality Merino wools. Were it not for such varying sets of conditions and the different classes of sheep evolved under each, this country would never have been able to offer to the world the wide range of quality and consequent variety of Merino wool which it has done. Exchange the two types of sheep mentioned, making each live under the conditions to which the other has been acclimitised, and it is remarkable to note the steady change that takes place in each case. After a short time either breed is scarcely recognisable. This change, however, is perhaps more conspicuous in the large-framed sheep. Its general tendency is towards a decline, and the bold carriage and upstanding appearance which so distinguishes the sheep in its own district becomes less marked. Until the breed becomes fully acclimatised there appears a tendency towards a general



Merino Rams in Riverina.

Many types of Merinos are bred in Riverina. The district is, however, noted for its big-framed, robust-woolled Merino sheep.

contraction of all the physical forces. The fleece, too, changes considerably in appearance. The staple has a tendency to become looser, and more open; and that bright, attractive appearance which usually characterises these wools in their own districts is less distinguishable.

Still more might be said with regard to the influence which climate exerts upon the Merino of Tasmania. The flocks of that State, long famous for the fine quality of their fleeces, while a high class of Merino, are, since they live in a much damper climate, greatly different from the Merino of the drier areas of other States.

New South Wales Types.

It takes time to become familiar with all the various flocks of this great State, and it is far too soon to attempt to speak for all districts. Yet in some parts of New South Wales, and more particularly in the areas suitable to the

Merino, the conditions are similar to those of the districts described, and the relationship of type to climate may, so far as they are concerned, be treated in a very general way.

The "Never Never."

The sheep of the Far West exhibit a type practically identical with that of the north-eastern district of South Australia. On this side of the Darling, however, a slight change may be noted. The Merino flocks of these areas generally are smaller than those of South Australia, but produce fleeces somewhat finer in quality. This is due rather to the nature of their pastures than to any great climatic difference, both districts being dry in the extreme.

Riverina.

The districts of the Riverina and those bordering on the Lachlan form the heart of the wool-growing region of the State. It would be difficult to fully describe the various classes of Merino kept within these districts, as

Merino Ewes. The type bred in Riverina.

This fine group of ewes represents the type usually found in this district. They are noted for their large frames, well developed bodies, and heavy weight fleeces, which are of a serviceable class of wool.

this portion of the State occupies such a wide expanse of country and embraces so many varied conditions, such as rainfall, soils and pastures. In those areas are to be found some most magnificent Merinos, unequalled for their great utility in the Commonwealth. While possessing all the splendid qualities of the improved type of Merinos, and exhibiting to the fullest extent all those characteristics most favoured by the breeders of to-day, yet it may be noted even here that type, under the influence of climate and the united efforts of breeders, is becoming more uniform year by year, and growing in favour with those requiring stud sheep throughout the greater portion of the drier areas of this and other States.

Although the flocks of Riverina may, perhaps, scarcely be thought as coarse in the wool as those of South Australia, yet there are few districts in New South Wales where there is produced a bigger-framed and more robust class of Merino.

Type of Merino bred in New England.

These sheep exhibit all the characteristics of the fine-woolled breed. Though smaller in frame they have shapely bodies and neatly developed necks, and represent that class which have given Australia a world's reputation for its fine quality Merino wool.

Western Slopes.

The undulating districts of the Western Slopes, with a greater altitude and a bigger rainfall, and more suitable to agriculture, produce a much less uniform type of Merino, and it is here that we find the largest admixture of British blood.

Broadly speaking, the Merino of these varied districts is smaller in frame than the same breed either in Riverina or the far West, and well illustrates the effect of climate on type.

Colder Districts.

East of this rise the tablelands, topped by the Great Dividing Range. The tablelands possess a cold, temperate climate, but the ranges are often covered with snow. Large areas of this region are fairly good sheep country, but much is of little or no value to the sheep breeder. Yet some of the finest Merino wools come from this and adjoining districts—wools which, with those of Western Victoria, have brought Australia a world-wide reputation for high-priced Merino wools. Nevertheless, the Merino sheep of such districts as Mudgee, New England, and in a less degree, the Liverpool plains, do not compare favourably as regards size of frame with many flocks of the districts already briefly described.

Further reference might be made to the Merino types of the undulating belts, hills, and ranges of the south-eastern divisions of the State, districts long famous for fine quality Merino sheep. Conditions exhibit greater variations here than in many of the districts already referred to, and fairly characteristic local variations in type may be met with in different parts of this area. Yet as a whole, the district has its peculiar breed, quite distinct from that of the warmer plains to the westward. The climate, though mild during the summer, is most severe in the winter. In much of this country sheep are depastured on the mountains only during the warmer months, and are taken back to the warmer districts when the summer is past.

Notwithstanding these extreme conditions some of the highest class Merino wools known in the State are grown in these districts, wools which, for their magnificent length of staple and superfine quality, compare most favourably with clips of established reputation grown in the districts beforementioned.

As has been already indicated the breed is less uniform and the type most suitable to the district does not appear to have been definitely fixed. Climate is the most important factor here as in other districts. Some breeders are striving to attain increase in frame, as in the sheep of the drier areas, with accompanying increase in length of staple. Others persevere with a more wrinkly-bodied type and a finer quality and denser fleece. We must allow these breeders to demonstrate by their experiments the best type for these districts. Our object is to trace the influence of climate on breed, and to compare these sheep with those reared in other districts.

Thus we have it that the Merino is a creature of circumstance, and by the co-operation of its breeders, who have long regarded this principle, there have been evolved in Australia many types whose strains are all more or less suited to their particular surroundings.

Coastal Districts.

The coast district is milder but too humid for the Merino, and the soils are generally too rich and heavy. The sheep kept east of the Great Divide are intended merely for the local meat trade, and comprise a few long-wools in addition to the usual British breeds.

Agricultural Breeds.

Hence we have in the less arid districts of Australia a temperate climate, free alike from extreme cold and extreme dryness, and not unfavourable to British breeds evolved under colder conditions, nor to the Merino, which is essentially a dry country sheep. This golden climatic mean favours almost all the well-known breeds of sheep in the world. The methods by which these breeds may be employed to the greatest advantage will be discussed at a later stage. It may be stated here, however, that the valuable types of British breeds kept in Australia must be maintained in a pure state, not so much for their own sake as for their usefulness in mating with the various types of Merino and breeds derived from the Merino. Whether in the course of time we shall find it necessary, instead of crossing these breeds with the Merino, to extend their use and endeavour to further develop them in a pure state, depends upon a wider knowledge of the science of Agriculture and principles of breeding. British breeds will only flourish on rich and abundant herbages, and require an ample winter supply of succulent feed. Experience has proved that to preserve weight of body and length and substance of fleece in many of the British breeds they must be provided with

The fine-woolled type, showing the breed reared in a colder climate.

A farmer's flock of rams, showing the type bred in New England.

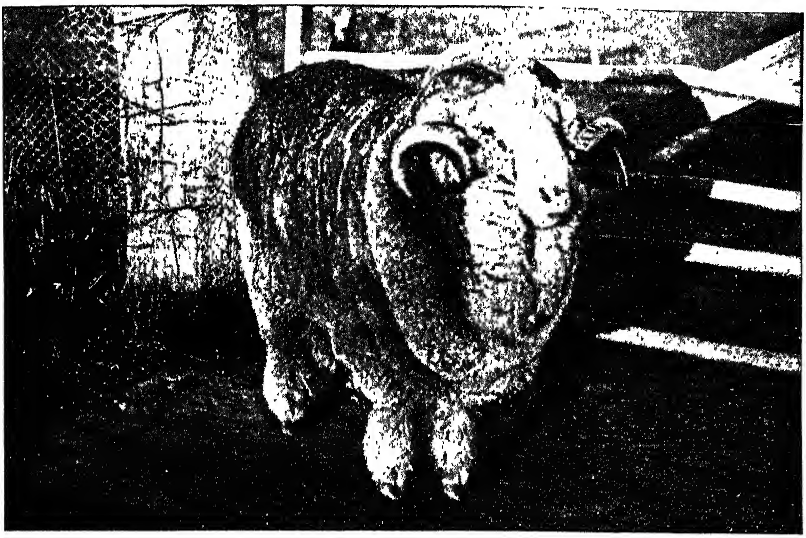
a larger and richer food supply than would suffice for Merinos. While rich pastures and a sufficient supply of suitable feed will develop those sheep, scanty and unnutritious grasses will tend to diminish all their most desirable qualities. Without due attention to these considerations we cannot hope to maintain these sheep in Australia in their highest perfection.

As has been already indicated, many districts of New South Wales are less suitable to the cultivation of the Merino in its pure state, except perhaps under such circumstances as when it is kept in large numbers. This means that within areas with a fair average rainfall, suitable to agriculture, and in connection with mixed farming, the fine-woolled Merino must be to a very great extent displaced by a type of cross-bred. The exact combinations have yet to be determined, and the influence of climate on the derived type will largely modify its usefulness. With the extensions of mixed farming, however, such British-Merino crosses would soon come into prominence; but the extent to which they would replace the Merino must be governed by circumstance, and to a very considerable degree depend upon climate. The Merino is accustomed to roam in large areas, whilst if the country is made available in smaller holdings, breeds of more domesticated habits must find greater favour with the settler.

Types for Districts.

Up to the present there has been little or no attempt to determine what types are most suitable to different districts of the State; each grower has had his own individual ideals and devoted his attention to their attainment. The need for a district or regional ideal has not apparently been fully recognised. At this stage, too, many flocks are not sufficiently well established to make such a plan a complete success. But the class of sheep suited to each district

These fine-woolled ewes were raised by a small grower in New England.



While some breeders are striving to attain increase in frame and length of staple in the fleece, others are persevering with the more wrinkly-bodied type. This ram shows the big-framed, plain-bodied type.

These ewes are noted for their plain bodies and well-developed necks and the magnificent quality and length of staple in the wool which they produce.

Type of Merino bred in South-Eastern District, New South Wales.

must be discovered, and district standards definitely fixed. There will then be no room nor excuse for the violent changes of opinion which we have witnessed in the past regarding the relative value of the various Merino strains. The work of standardisation can only be achieved by paying due attention to local conditions. Up till the present the whole matter of type has scarcely advanced beyond the experimental stage.

Shows.

Perhaps nothing has so assisted in the development of the best types of stock, and especially of sheep, as the annual Shows of the various district societies, and especially the exhibitions of the Royal Agricultural Society. Still more important is that magnificent collection of sheep seen year by year at the exhibition of the New South Wales Sheep-breeders' Association. In the past it has been customary to classify the Merino as "fine," "medium," or "coarse" woolled, and these groups have been further subdivided into "housed" and "unhoused" sections. This has done much for the standardisation of the various types, but New South Wales is too large a country, and possesses too wide a range of climate, to make such wholesale competition fair and equitable to all breeders.

A Suggestion.

We venture a suggestion which, if adopted, would enable these various exhibitions to do still more for the sheep industry of New South Wales. The State could be divided into districts according to climate and physical geography, and exhibits invited from each district. No other plan would more promptly determine the type of sheep suitable to each district. The advantage to the grower and the breeder would be twofold: not only would he know the type of sheep best suited to his own district, but foreign buyers would quickly see to what district they had to look for the class of wool they required.

The object of this paper has been simply to outline on broad principles a system for the keeping of different varieties of sheep which have evolved in other countries, and under conditions not altogether in accord with those which exist in Australia. In our next we propose treating the question more practically, dealing with the various types for the purpose of classifying them according to their characteristics and consequent usefulness.

Fumigating Rabbit Burrows.

Respecting the note under this heading which appeared on page 296 of our April issue, we are informed that the smoke mixture prepared from ammonia and muriatic (hydrochloric) acid, is patented by Mr. F. S. Greer, and that it cannot be used without his consent. When Mr. Guthrie recommended Messrs. Conroy and Doyle to use this mixture, he was not aware that it was already the subject of a patent.

Some Experiments with Fungicides used for the Prevention of "Stinking Smut" (Bunt), Cowra, 1909.*

GEO. L. SUTTON and R. G. DOWNING, Cowra Experiment Farm.

THESE experiments are in continuation of those carried out in previous years at the Cowra Experiment Farm. The fungicides experimented with in the present series were:—

(1) A one quarter ($\frac{1}{4}$) per cent. solution of Formalin.

(2) A two (2) per cent. solution of Bluestone.

(3) A two (2) per cent. solution of Bluestone supplemented by immersion in Lime-water.

(4) Bordeaux Mixture.

(5) A two (2) per cent. solution of Bluestone, to which was added sufficient Salt to make a saturated solution.

(6) A saturated solution of coarse Salt and water.

(7) "Fungusine," a proprietary preparation.

Objects of the Experiments.

The present experiments have been designed to furnish answers to the following questions:—

(I) To what extent do certain fungicides (or "pickles") destroy the spores of bunt ("smut") on the seed grain, and so prevent the occurrence of the disease in the crop resulting from the planting of the treated grain?

(II) Have these fungicides an injurious effect upon the vitality and vigour of the seed grain?

(III) Do these fungicides prevent reinfection to any appreciable extent?

(IV) In connection with the combined treatment with Bluestone and Lime-water, is it detrimental in any way to delay the immersion of the grain in Lime-water for some time after the draining consequent upon its treatment with Bluestone?

(V) Are the least injurious effects experienced when the seed is treated immediately before it is planted, or can the seed be treated with safety some time before it is intended to plant it? This section was conducted with three fungicides only, viz.:—Bluestone, Bluestone and Lime, and Fungusine.

The general scope of the investigations was the same as in previous years, with such omissions and additions as the results of the former experiments indicated as being desirable.

* A preliminary note, giving a summary of the results of these experiments, was published in April *Agricultural Gazette.*

The treatment with hot water has been omitted from these trials because of its lack of advantages over other methods more suitable for farmers' conditions.

Treatments with Fungusine, bluestone and salt, and salt have been included; the first-named because it is a proprietary preparation, placed on the market with certain strong claims made for it as a preventive of "smut." It was deemed desirable to see upon what foundation these claims are based.

Treatment with a bluestone solution being general amongst our farmers, a method was sought which would facilitate the removal of the unbroken bunt balls when the grain was poured into the solution. It was learnt from Mr. John Hanns, a Mallee farmer, near Sea Lake, Victoria, that the custom of the farmers in his vicinity was to use salt-water from the lake near by with which to make the bluestone solution. Excellent results were reported from this practice. As the addition of salt to the bluestone solution would increase its density, and thus facilitate the removal of the unbroken bunt balls, it was determined to compare this mixture with the other methods under trial.

The absolute necessity for removing the unbroken bunt balls from seed grain is confirmed by the results of an experiment carried out by Mr. R. Hurst on the stud plots at the Wagga Experiment Farm during the past season. Some unbroken bunt balls and smutted grain were soaked in a solution of formalin sufficiently long to destroy the bunt spores on the grain. The unbroken bunt balls were then taken out of the solution and crushed up. The contents of the crushed balls were then used to infect some clean grain, which was planted at once. The plants resulting from this grain were examined at the proper stage, and it was then found that every plant was smutted, *i e.*, it contained at least one bunt ball.

The "smutted" grain that had been treated with formalin at the same time as the unbroken bunt balls, was also planted and examined. It was found that every one of the resulting plants was entirely free from bunt. This affords conclusive evidence that the solution used to treat the grain and unbroken bunt balls was strong enough to destroy loose bunt spores, though the trial proved it to be entirely ineffective in destroying the bunt spores enclosed in the unbroken ball.

Treatment with a solution of common salt and water was included, to ascertain whether it in itself was at all efficient in preventing bunt. This was done though previous experiments, conducted by Mr. McAlpine at Port Fairy, had indicated that it was quite inefficient.

Preparation of Materials.

The procedure adopted in dealing with the various plots was similar to that of previous years, and was as follows:—

The Bluestone (2 per cent.) Solution was made by dissolving bluestone in water at the rate of 2 lb. of bluestone to 10 gallons of water.

The Lime-water used was a thin milk of lime, and was made by slaking freshly-burnt lime with water, using about 1 lb. of lime to 20 gallons of water.

The Bluestone and Salt Solution was made by adding as much salt to a 2 per cent. solution of bluestone as the latter would absorb in two hours. The amount of salt absorbed amounted to about 33 per cent. For the

purpose of this experiment, the procedure adopted was as follows :—1 lb. of course salt was suspended in 40 oz. of a 2 per cent. bluestone solution, which was warmed to 140° Fahr., and kept at that temperature for two hours. At the end of this period, the blue colour of the original solution had changed to a more or less greenish tint. The salt still remaining undissolved was dried and weighed, and was found to be slightly less than 3 oz.

The Bordeaux Mixture was made in the recognised way, at the rate of 6 lb. of bluestone and 4 lb. of lime to 30 gallons of water.

The Salt Solution was made by dissolving as much salt in water as the latter would take up.

The Formalin Solution was prepared by mixing one part (1 lb.) of Commercial Formalin (40 per cent.) in 400 parts (40 gallons) of water.

Untreated Grain.—In order that only heavy grain (" sinkers ") should be used in the plots to be sown with untreated seed, as well as on the plots treated with fungicides, the light grains were removed from the whole of the grain to be used in the experiment by pouring it gently into a vessel containing cold water, the light grains (" floaters "), chaff, &c., which remained on the surface being removed, and the remainder of the grain dried. This operation was done rapidly enough to prevent the grain becoming more than wetted on the surface. Grain not treated in any other way was regarded as untreated.

Grain treated with Formalin, Bluestone, Bluestone and Salt, Salt-water, or Bordeaux Mixture.—The seed for each plot was placed in a suitable vessel and a solution of the required strength poured over it. The grain was then stirred, to ensure that every grain would be thoroughly wetted. After it had been immersed for five minutes, the solution was poured off and the seed dried in the sun or hung up to drain, as the nature of the experiment demanded.

Grain treated with Bluestone and Lime-water.—The seed for each plot was immersed in a solution of bluestone for five minutes, and after the solution of bluestone had been poured off, lime-water was poured on the seed and allowed to remain for about three minutes, the grain in the meantime being stirred about.

Grain treated with Fungusine.—This was treated in accordance with the directions supplied by the proprietors. The material, which is in the form of a fine powder, was thoroughly mixed at the rate of 1 lb. to 1 gallon of water, and was then poured over the prescribed quantity of grain, and thoroughly mixed with it. It was noticed that the powder did not dissolve in the water, but was held in suspension, readily sinking to the bottom unless agitated. The grain, after being treated, was spread out to dry and was then ready for sowing.

Infected or Smutted Seed.—Seed of the different varieties was thoroughly infected with "smut" by being shaken about in a suitable vessel with a quantity of crushed-up bunt balls, until the wheat grains were thoroughly covered with smut spores and presented the appearance of having been rolled in soot.

Procedure in Conducting the Experiments.

In these experiments the examination of the relative effects of the different fungicides upon the vitality of the seeds has been made by comparing the number of germinations which resulted from seeds planted after being treated in a particular way, with the number of germinations resulting from planting the same number of untreated seeds at the same time.

It has been assumed that the difference between the number of germinations resulting from the planting of untreated seed, and that resulting from the planting of seed treated in some particular way, is the number of seeds which have been killed by that particular treatment. It will be noted in some cases that the actual number of germinations from treated seeds is greater than the germinations from the same number of untreated seeds—that, in fact, treatment with a fungicide has apparently had the effect of increasing the germinating quality of the grain. In such cases the sign of subtraction (–) has been placed before the figures in the column denoting the number apparently killed by the fungicide. This is apparently an anomaly, but it is in accordance with the results obtained previously, and it is therefore reasonable to suppose that a certain number are destroyed by natural causes after being planted in the field; also that certain methods of treatment protect the grain from destruction in this way. Such a condition makes comparisons difficult. It also appears unavoidable, though in future experiments the difficulty may be reduced by planting check plots of untreated grain in seed-boxes, where it can be protected from these natural causes of destruction.

In order to reduce the probability of inconsistencies, the number of check rows of untreated seeds was increased beyond the number used in former years. These rows were planted at regular intervals amongst the plots of treated seed. For every 500 grains of treated seed sown there were 3,000 grains of untreated seed planted.

The soil on which the experiments were planted was a chocolate granitic loam—typical wheat land. It was free enough to be suitable for the purpose, and as uniform in texture and as even in character as one would expect to obtain. It was in excellent tilth, moist and warm. The conditions for germination throughout the trial were good.

Every possible care was taken to have the whole of the seed planted under conditions as uniform and regular as possible, the experience gained with the previous experiment of this character being helpful in this direction. The seed, one grain at a time, was dropped by hand in holes which were made at a regular uniform depth (1½ inch) and distance apart (3¼ inches) by means of a toothed wheel. The seed, after it was dropped, was compressed into the moist soil by having a heavy wheel rolled over it, and it was then covered with loose earth by means of a rake.

The counting of the plants was commenced soon after they were observed to be well above the ground, and was continued at intervals until it was considered no more plants would appear.

SECTION I.

OBJECT.—*To determine to what extent the different "pickles" or fungicides destroy the spores of "smut" (bunt) on the seed grain, and so prevent the occurrence of smut in the crop resulting from the planting of the treated grain.*

The relative efficiency of the different methods was determined by ascertaining the number of smutty plants which were produced after thoroughly infected seed had been treated according to the various methods under trial. For purposes of comparison, plots of infected but untreated seed were also sown.

The number of smutty plants was determined by making an examination of the plants in the different plots at a suitable time after they had flowered. Any plant containing even only one bunt ball was considered smutty and was counted as such. The results of this examination are given in Table I.

In this table, the differences between the numbers of bunty plants which are recorded as being found in the various treated plots show the relative efficiency of the different treatments.

The numbers of bunty plants found in the plots sown with infected but untreated seed show the bunt-liability of the different varieties used in this experiment.

As the result of taking an average of the three varieties under each treatment, it is found that the different fungicides were efficient in the following order:—

Bluestone and Salt	with	·8	per cent.	bunty plants.
Bluestone	"	2·5	"	"
Fungusine	"	6·4	"	"
Bluestone and Lime	"	7·2	"	"
Bordeaux Mixture	"	14·7	"	"
Formalin	"	18·2	"	"
Salt-water	"	49·2	"	"

These figures indicate that bluestone and salt, bluestone, Fungusine, and bluestone and lime are satisfactory "smut" preventives. Because of its satisfactory behaviour in previous years formalin must also be included. The low position held this year by formalin is due to the result obtained when Federation wheat was treated with it. The results in this case appear abnormal, even after taking into consideration the latitude which field experiments of this character apparently demand.

Though the results from Bordeaux mixture are not very satisfactory, further trial with it is desirable, for the results are better than those of formalin, which past experience has shown to be a satisfactory bunt preventive.

Salt-water has proved entirely unsatisfactory, and the results obtained confirm those of Mr. McAlpine. Treatment with salt-water may be considered as being quite unsuitable.

TABLE I.

Showing the relative efficiency of the various Fungicides for destroying the Bunt Spores on the Seed Grain.
Seed infected, 14/7/09; seed treated, 14/7/09; seed planted, 14/7/09.

Method of Treatment after Infection.	No. of Seeds of each variety planted.	Bobs.					Comeback.					Federation.					Average.	
		No. of Plants.			Per cent.		No. of Plants			Per cent.		No. of Plants.			Per cent.		Per cent.	
		Clean.	Bunty.	Total.	Clean.	Bunty.	Clean.	Bunty.	Total.	Clean.	Bunty.	Clean.	Bunty	Total	Clean.	Bunty.	Clean.	Bunty
Untreated	1,250	80	790	870	9·2	90·8	445	490	935	47·6	52·4	250	720	970	25·8	74·2	27·5	72·5
Bluestone, 2 %	500	192	3	195	98·5	1·5	260	5	265	98·1	1·9	320	14	334	95·8	4·2	97·5	2·5
Bluestone, 2 %, and Lime ...		271	31	302	89·7	10·3	299	12	311	96·1	3·9	334	26	360	92·8	7·2	92·8	7·2
Bluestone, 2 %, and Salt ..		338	2	340	99·4	·6	318	1	319	99·7	·3	422	6	428	98·6	1·4	99·2	·8
Bordeaux Mixture		300	82	382	78·5	21·5	343	15	358	95·8	4·2	356	80	436	81·6	18·4	85·3	14·7
Formalin		290	26	316	91·8	8·2	330	8	338	97·6	2·4	226	179	405	55·8	44·2	81·8	18·2
Fungusine		299	56	355	84·2	15·8	365	3	368	99 2	·8	427	11	438	97·5	2·5	93·6	6·4
Salt-water		95	249	344	27·6	72·4	211	119	330	64·0	36 0	268	172	440	60·9	39·1	50·8	49·2

TABLE II.

Showing the efficiency of Bluestone as a preventive of Bunt when the seed is immersed in it for varying periods.

Variety.	For 5 Minutes.			For 15 Minutes.			For 30 Minutes.			For 60 Minutes.		
	No. of Plants.		Percentage of Clean Plants.	No. of Plants		Percentage of Clean Plants.	No. of Plants.		Percentage of Clean Plants.	No. of Plants.		Percentage of Clean Plants
	Clean.	Bunty.		Clean.	Bunty.		Clean.	Bunty.		Clean.	Bunty	
Bobs	96	2	97·9	109	3	97·3	112	4	96·5	80	2	97·5
Comeback	130	3	97·9	83	1	98 8	111	1	99·1	82	0	100·0
Federation	160	7	95·8	163	4	97·6	169	9	94·9	188	2	98·9
Average	129	4	97·2	118	3	97·9	131	5	96 8	117	1	98·8

An extension of this section was carried out to ascertain whether a longer immersion in bluestone than the usual one would be more effective in destroying the bunt spores on the seed. Different portions of smutted seed were immersed in bluestone for 5, 15, 30, and 60 minutes, respectively, and then planted. The results obtained are shown in Table II.

From these results it will be seen that nothing is gained by immersing the seed for longer than five minutes. The effect in preventing smut in the resulting crop is practically as good after five minutes' immersion as after sixty minutes.

SECTION II.

OBJECT.—*To determine whether certain fungicides used for the prevention of "smut" have an injurious effect upon the germination of the seed grain which is treated with them.*

This trial was conducted with three varieties. Five hundred seeds of each variety were treated by the different methods being tried. The seeds were treated at the same time, and after being treated were dried in the sun, and then planted on the same day. In Table III will be found the results from the plots in this section.

On comparing the averages of the results of the three varieties, it is found that the treatment with—

Bluestone apparently kills 30·2 per cent. of the treated grain.

Bluestone and Lime	apparently kills	10·2	per cent.	of the treated grain.
Bluestone and Salt	"	8·7	"	"
Salt-water	"	8·4	"	"
Formalin	"	3·8	"	"
Bunt spores (only)	"	2·5	"	"
Bordeaux Mixture	"	·8	"	"
Fungusine	"	—1·3	"	"

It appears that Fungusine assists rather than retards germination. The actual number of plants which grew from seeds treated with it was greater than of those which grew from untreated seed; but from this it does not follow that Fungusine improves the vitality of the seed grain. A reasonable explanation of this case seems to be that Fungusine does not injure the germinating power of the seed, and that its effect is to protect the seed grain from those field pests which (as these experiments show) attack and destroy it.

Because of its ability to destroy smut spores, combined with its non-injurious effect upon the vitality of seed grain, treatment with Fungusine appears to be one of the most satisfactory methods for the farmer to adopt.

Bordeaux mixture had very little injurious effect upon the seed grain, but its value to the farmer in this respect need not be considered, because it has, up to the present, shown itself to be only an indifferent preventive of bunt.

Under the favourable conditions prevailing when the experiment was conducted, formalin proved to be only slightly injurious. Former experiments have, however, shown that when the conditions at planting-time are dry and

TABLE III.

Showing the number of seeds which after treatment with the different fungicides germinated at stated periods during the trial; also the percentage number of seeds which were apparently killed by the different treatments. Seed treated, 13/7/09; planted, 14/7/09.

Treatment.	No. of Seeds planted.	Bobs.					Comeback.					Federation.					Average.				
		No. of Plants above ground.			Percentage of Seeds germinated.	Percentage of Seeds killed.	No. of Plants above ground.			Percentage of Seeds germinated.	Percentage of Seeds killed.	No. of Plants above ground.			Percentage of Seeds germinated.	Percentage of Seeds killed.	No. of Plants above ground.			Percentage of Seeds germinated.	Percentage of Seeds killed.
		9/8/09.	17/8/09.	1/9/09.			9/8/09.	17/8/09.	1/9/09.			9/8/09.	17/8/09.	1/9/09.			9/8/09.	17/8/09.	1/9/09.		
Uninfected and untreated	3,000	2,364	2,556	2,532	84·4	..	2,436	2,664	2,676	89·2	..	2,400	2,748	2,712	90·4	.	2,420	2,656	2,640	88·0	.
Infected with Bunt spores	1,250	905	1,075	1,035	82·8	1·6	940	1,090	1,065	85·2	4·0	935	1,115	1,105	88·4	2·0	920	1,093	1,068	85·5	2·5
Bluestone 2%	500	96	181	218	43·6	40·8	143	283	291	58·2	34·0	266	375	373	74·6	15·8	168	279	294	57·8	30·2
Bluestone and Lime	500	230	368	359	71·8	12·6	266	359	361	71·6	17·0	400	452	146	92·8	1·2	318	393	388	77·8	10·2
Bluestone and Salt	500	232	369	367	73·4	11·0	248	356	358	72·2	17·6	429	470	464	89·2	—2·4	319	398	396	79·3	8·7
Bordeaux Mixture	500	384	418	408	81·6	2·8	375	427	425	85·0	4·2	444	477	475	95·0	—4·6	401	440	436	87·2	·8
Formalin	500	340	404	398	79·6	4·8	330	395	399	79·8	9·4	436	472	466	93·2	—2·8	368	423	421	84·2	3·8
Fungusine	500	355	435	427	85·4	—1·0	336	452	439	87·8	1·4	444	479	474	94·8	—4·4	378	455	446	89·2	—1·3
Salt-water	500	291	375	360	72·0	12·4	299	382	368	73·6	15·6	373	471	466	93·2	—2·8	321	409	398	79·6	8·4

unfavourable for germination, its injurious effect is very much increased. This fact lessens the value of formalin for the prevention of smut in our wheat districts, where the conditions at planting-time are often dry.

The destructive effect of bluestone is again apparent, and because of this its value to the farmer is very much lessened, even though it is such an effective preventive of smut. The necessity of supplementing it with some ameliorating agent is emphasised by these results. Lime has again proved satisfactory in this respect. The relative results of the effect of the "bluestone," and the "bluestone and lime" methods, are approximately the same, though not as satisfactory as in former years. The mixture "bluestone and salt," tried this year for the first time, appears even more satisfactory than the "bluestone and lime." The former method has the additional advantage of being more easily practised than the latter, and will displace it if it continues to prove satisfactory in future trials.

Though it is very rarely advisable to make modifications of farm practice because of the result of one trial, an exception may be made in this case, as the practice of using "bluestone and salt" has been followed with good results by a certain section of farmers for some time. The addition of salt to the bluestone solution is, therefore, recommended to those who this season propose to use bluestone for pickling their wheat.

The amount of salt which is to be added for best results has not yet been determined, but this will be found out by future experiments. Tentatively it is suggested that the weight of salt added be equal to that of the bluestone. The present experiment shows that it is not injurious to add all the salt that the bluestone solution will absorb in two hours.

It is interesting to note that a thorough infection with smut has an appreciable injurious effect upon the vitality of the seed grain. In this case it is responsible for destroying 2½ per cent. of the seed grain.

Not only is the seed destroyed by most of the methods adopted, but, with the exception of that treated with Bordeaux mixture, the seed which does grow does not germinate as rapidly nor at the same rate as untreated seed. This is shown in Table IV, in which the percentage rates of the total germinations on different dates, prior to the final counting on 1st September, 1909, are given. The actual number of germinations on the date when the final counting took place is represented by 100.

It will be noticed, in some cases, that when the second count was made, the percentage of plants was greater than 100, which is the number representing the actual number of plants growing when the third and final count was made. This implies that, in these cases, there were less plants at the third date than at the second. It seems reasonable to account for this apparent discrepancy by assuming that the plants which disappeared were produced by weak seeds which had sufficient vitality to germinate, but not enough to support the young plant beyond its initial stage.

A subsidiary experiment of the foregoing section was also carried out. Its object was to ascertain what effect, if any, immersion in the bluestone solution for increased periods would have upon the vitality of the grain. Portions

Table IV.

Showing the effect of the different treatments in retarding the germination of the seed during the germination period.

The relative percentages of the total plants which were growing at stated periods, compared with the final counting made on 1st September, 1909, when the germination was assumed to be completed.

Variety.	9th August, 1909.									17th August, 1909.								
	Uninfected and Untreated.	Infected.	Bluestone, 2 per cent.	Bluestone and Lime.	Bluestone and Salt.	Bordeaux Mixture.	Formalin.	Fungusine.	Salt-water.	Uninfected and Untreated.	Infected.	Bluestone, 2 per cent.	Bluestone and Lime.	Bluestone and Salt.	Bordeaux Mixture.	Formalin.	Fungusine.	Salt-water.
Bobs ...	93·3	87·4	44·0	80·7	76·8	94·1	85·4	83·1	80·8	100·9	103·8	83·2	102·5	100·5	102·4	101·7	101·8	104·2
Comeback ...	91·0	88·2	49·1	73·6	69·2	88·2	82·7	76·5	81·2	99·5	102·3	96·1	96·6	99·4	100·4	99·0	102·9	103·8
Federation...	90·1	84·6	71·3	89·6	92·4	93·4	93·5	93·6	80·0	101·3	100·9	100·5	97·0	101·2	100·4	101·2	101·0	101·1
Averages ...	91·5	86·7	54·8	81·3	79·5	91·9	87·2	84·7	80·7	100·6	102·3	93·3	93·7	100·4	101·1	100·6	101·9	103·0

Table V.

Showing the effect of Bluestone on the germination when the seed is immersed in it for varying periods.

	Untreated and Uninfected.				Immersion for 5 Minutes					Immersion for 15 Minutes.					Immersion for 30 Minutes.					Immersion for 60 Minutes.				
	No. of Plants on—			Percentage of Plants on 1/9/09.	No. of Plants on—			No. of Plants killed.	Percentage of Plants killed.	No. of Plants on—			No. of Plants killed.	Percentage of Plants killed.	No. of Plants on—			No. of Plants killed.	Percentage of Plants killed.	No. of Plants on—			No. of Plants killed.	Percentage of Plants killed.
	9/8/09	17/8/09	1/9/09		9/8/09	17/8/09	1/9/09			9/8/09	17/8/09	1/9/09			9/8/09	17/8/09	1/9/09			9/8/09	17/8/09	1/9/09		
Bobs ...	197	213	211	84·4	48	90	109	102	48·3	42	105	108	103	48·8	58	108	139	72	34·1	41	87	104	107	47·3
Comeback ..	203	222	223	89·2	72	142	145	78	34·9	34	70	91	132	59·2	46	97	124	90	44·3	40	77	99	124	55·6
Federation ..	205	229	226	90·4	133	183	187	39	17·2	143	203	207	19	8·4	151	204	204	22	9·7	163	220	219	7	3·1
Average ..	202	221	220	88·0	84	140	147	73	33·5	73	126	135	85	38·8	85	136	222	64	29·3	83	128	141	79	35·3

of seed were immersed for 5, 15, 30, and 60 minutes respectively, and the germination resulting from the planting of such treated seed determined. The results are given in Table V.

It will be seen from the above results that the germination was not more injuriously affected by longer immersions in the bluestone solution.

SECTION III.

OBJECT.—*To determine whether any of the fungicides used prevent re-infection by smut of the seed treated with them.*

Seed of the three varieties was treated according to the different methods under trial, and, after being dried, was then infected with bunt in the manner described. The seed, after being infected, was planted. Plots were also planted with untreated but infected seed, in order to ascertain the degree of infection to which the treated seed was subjected.

The ability of the different fungicides to prevent reinfection was determined by the relative number of clean and bunty plants found in the resulting crop. The larger the proportion of clean plants, the greater the ability of the particular fungicide to prevent reinfection.

The proportion of clean plants was determined by an examination made after the plants had flowered. In Table VI will be found the results of this examination.

By taking the average of the three varieties under each treatment, it is found that the fungicides are effective in preventing reinfection in the following order:—

Bluestone and Salt ...	with 90·0	per cent.	of clean plants.
Bluestone	,, 79·3	,,	,,
Fungusine	,, 69·3	,,	,,
Bluestone and Lime ...	,, 67·2	,,	,,
Bordeaux Mixture ...	,, 55·1	,,	,,
Formalin	,, 35·4	,,	,,

Pride of place is held by bluestone and salt, but its position is largely discounted by the fact that, when the examination for the clean plants was made, there were very many less plants found growing from the seed treated with this method than from seed treated in any other way. Until additional results are available it appears desirable to ignore those obtained with bluestone and salt this season.

This being understood, bluestone ranks first in preventing reinfection, followed by Fungusine and bluestone and lime, in the order given. Bordeaux mixture and formalin are poor in preventing reinfection.

The advantage of a method which, in addition to destroying the smut spores on the seed grain, also prevents the reinfection of that grain, may not be at first realised. When, however, it is understood that the possibility of treated seed becoming reinfected is very considerable as the result of being placed in old bags or bins, or through machines which have held smutted wheat, the value to a farmer of a treatment which will aid in preventing reinfection is at once apparent.

TABLE VI.

Showing the extent to which each of the Fungicides prevents reinfection after treatment.

Seed treated, 14/7/09; infected, 14/7/09; planted, 14/7/09.

Method of Treatment before Inspection.	No. of Seeds of each variety planted.	Bobs.					Comeback.					Federation.					Average.	
		No. of Plants.			Percentage.		No. of Plants.			Percentage		No of Plants.			Percentage.		Percentage.	
		Clean.	Bunty.	Total.	Clean.	Bunty.	Clean.	Bunty.	Total.	Clean.	Bunty.	Clean.	Bunty.	Total.	Clean	Bunty.	Clean.	Bunty.
Untreated	1,250	80	790	870	9·2	90·8	445	490	935	47·6	52·4	250	720	970	25·8	74·2	27·5	72·5
Bluestone, 2 %	500	148	54	202	73·3	26·7	144	12	156	82·3	7·7	287	110	397	72·3	27·7	79·3	20·7
Bluestone, 2 %, and Lime..		124	152	276	45·0	55·0	316	17	333	94·9	5·1	218	135	353	61·8	38·2	67·2	32·8
Bluestone, 2 %, and Salt...		131	26	157	83·4	16·6	156	6	162	96·3	3·7	235	25	260	90·4	9·6	90·0	10·0
Bordeaux Mixture ...		207	193	400	51·7	48·3	321	70	391	82·1	17·9	106	230	336	31·5	68·5	55·1	44·9
Formalin		62	321	383	16·2	83·8	211	138	349	60·5	39·5	126	300	426	29·5	70·5	35·4	64·6
Fungusine		140	100	240	58·3	41·7	301	47	348	86·5	13·5	194	114	308	63·0	37·0	69·3	30·7

SECTION IV.

OBJECT.—*To determine whether, in connection with the combined treatment with bluestone and lime-water, it is detrimental in any way to delay the immersion of the grain in the lime-water for some time after the draining necessary because of its treatment with bluestone.*

This section was subdivided into two divisions—(1) To ascertain the effect of the modifications on the germination of the grain; and (2) to ascertain the effect of the modifications in preventing bunt in the resulting crop.

Seed of each of the three varieties was treated with a 2 per cent. solution of bluestone, and was then divided into four portions, which were respectively treated with lime-water—(a) immediately after, (b) one quarter of an hour after, (c) one half-hour after, and (d) one hour after, removal from the bluestone solution.

To ascertain the effect of the different modifications upon the germination, the plants were counted as they appeared above the ground, and then at intervals until it was considered that no more plants would appear. The results will be found in Table VII.

By taking averages of the results of the three varieties, it is found that the percentage rate of germination is as follows:—

Immediately after bluestoning	... ...	77·9	per cent.
Fifteen minutes ,,	... ...	76·4	,,
Thirty ,, ,,	... ...	82·5	,,
Sixty ,, ,,	... ...	73·2	,,

Seeing that it is apparently necessary to allow a considerable latitude between the results in field experiments of this character, these results may be taken as remarkably even. There is such a comparatively slight difference between these average results that it seems safe to conclude that it is immaterial when the lime-water treatment supplements that of bluestone.

These results are in the direction of confirming the theory that the decreased germination results following the use of bluestone are not due to injury to the seed, but rather to the young plant coming into contact with the film of bluestone surrounding the seed.

To ascertain the effect of the modifications upon the ability of the treatment to prevent smut in the resulting crop, an examination of the growing plants was made after they had flowered. This was to determine the number of bunty plants found growing in the different plots. The greater the number of clean plants in any plot, the more effective is that particular treatment in preventing bunt.

The result of the examination is given in Table VIII.

From a comparison of the averages of the three varieties, it is found that the relative efficiency of the different methods is as follows:—

Treatment with lime-water	One hour after bluestoning,	97·8	per cent. clean plants.
	One half-hour ,,	94·3	,, ,,
	One quarter-hour ,,	92·9	,, ,,
	Immediately ,,	92·7	,, ,,

TABLE VII.

Showing the effect on the germination, of delaying treatment with Lime-water, after Bluestone. 250 seeds of each variety planted; seed treated, 14/7/09; planted, 14/7/09.

Variety.	Treatment with Lime-water.															
	Immediately after Bluestone.				15 minutes after Bluestone.				30 minutes after Bluestone.				60 minutes after Bluestone.			
	No. of Plants on—			Percentage of Plants on 1/9/09.	No. of Plants on—			Percentage of Plants on 1/9/09.	No. of Plants on—			Percentage of Plants on 1/9/09.	No. of Plants on—			Percentage of Plants on 1/9/09.
	9/8/09	17/8/09	1/9/09		9/8/09	17/8/09	1/9/09		9/8/09	17/8/09	1/9/09		9/8/09	17/8/09	1 9 09	
Bobs	145	184	180	72·0	117	168	180	72·0	100	175	186	74·4	65	150	164	65·6
Comeback	133	180	181	72·4	97	153	169	67·6	123	190	195	78·0	84	173	176	70·4
Federation	200	226	223	89·2	186	229	224	89·6	229	241	238	95·2	127	210	209	83 6
Average	159	196	195	77 9	133	183	191	76·4	151	202	206	82·5	92	178	183	73·2

TABLE VIII.

Showing the effect upon the efficiency of the "Bluestone and Lime" treatment as a smut preventive, when the treatment with lime-water is delayed after bluestoning the seed. Seed treated and planted, 14/7/09; examined for smut, 22/12/09.

Varieties.	Lime-water immediately after Bluestone.				Lime-water 15 minutes after Bluestone				Lime-water 30 minutes after Bluestone.				Lime-water 60 minutes after Bluestone.			
	No. of Clean Plants.	Percentage of Clean Plants.	No of Bunty Plants.	Percentage of Bunty Plants.	No. of Clean Plants.	Percentage of Clean Plants.	No. of Bunty Plants.	Percentage of Bunty Plants.	No. of Clean Plants.	Percentage of Clean Plants.	No. of Bunty Plants	Percentage of Bunty Plants.	No. of Clean Plants.	Percentage of Clean Plants.	No. of Bunty Plants.	Percentage of Bunty Plants
Bobs	135	89·4	16	10·6	139	90·9	14	9 1	136	87·8	19	12 2	147	94 8	8	5·2
Comeback	149	96·1	6	3·9	135	96·4	5	3·6	159	99·4	1	·6	152	99 3	1	·7
Federation...	167	92·8	13	7·2	167	91·2	16	8 8	196	95 6	9	4·4	174	99 4	1	·6
Average	150	92·7	12	7·3	147	92·9	12	7·1	164	94·3	10	5 7	157	97·8	3	2·2

The differences between the results are very slight, but they are almost entirely consistent in the direction of increased efficiency, as the result of delaying the treatment with lime-water. This indicates the desirability of delaying this portion of the treatment. Such may be regarded as a safe practice, seeing that the previous division of this experiment indicated that the germination was not likely to be impaired as the result of the delayed supplementary treatment.

SECTION V.

OBJECT.—*To determine whether it is detrimental, or otherwise, to treat the seed with "Bluestone," "Bluestone and Lime," or "Fungusine," some time before it is required for planting.*

Seed of three varieties was treated according to the different methods prescribed, and divided into several portions, which were respectively planted in seed-boxes, a few days after, a month after, and three months after being treated. For purposes of comparison, untreated seeds of the same variety were planted on the first date.

The results obtained are given in Table IX.

TABLE IX.

Showing the effect of planting treated seed at different intervals after treatment.

Seed treated on 14/7/09; 100 seeds of each variety planted in seed boxes.

Variety.	Untreated.	Bluestone.			Bluestone and Lime.			Fungusine.		
		Planted after treatment.			Planted after treatment.			Planted after treatment.		
		3 days.	33 days.	92 days.	3 days.	33 days	92 days.	3 days.	33 days	92 days.
Bobs	88	61	66	39	95	84	78	84	81	81
Comeback . .	94	62	87	60	92	82	80	[illegible]	[illegible]	87
Federation ..	100	94	92	89	95	91	96	[illegible]	[illegible]	86
Average ...	94	72·3	81·6	62·6	94	85·6	84·6	89·6	88·6	84·6

These results are not entirely consistent, but taken in a general way they indicate that the seed can be treated at least three months before it is required without incurring much risk of loss.

Summary.

The absolute necessity for the removal of unbroken bunt balls from the seed grain before "pickling" it, is emphasised.

BLUESTONE, as formerly, proved to be a splendid preventive of "smut," and also satisfactory in preventing reinfection; but it also, as formerly, proved to have a very disastrous effect upon the vitality of the seed grain treated with it. This year 30 per cent. of the seed grain was destroyed by the bluestone treatment. It is therefore advisable to use some ameliorating agent with it, and for this purpose lime and salt are recommended.

Allowing the grain to remain in the bluestone solution for longer periods than five minutes did not increase the destructive action of the bluestone, nor increase its efficiency as a smut preventive.

BLUESTONE AND LIME.—This was not as satisfactory as bluestone, as a bunt preventive, nor in preventing reinfection; but its destructive effect upon the vitality of the seed was very much less. As the result of supplementing the bluestone treatment with lime-water, some 20 per cent. of the grain was saved.

When using this treatment it is advantageous to delay the treatment with lime-water, rather than to treat the seed immediately after bluestoning. The effect of delaying the supplementary treatment is in the direction of increasing the efficiency of the combined treatment, without increasing its destructive effect upon the vitality of the seed.

BLUESTONE AND SALT proved the most effective preventive of bunt tried this season. It was better than lime in lessening the destructive action of bluestone upon the vitality of the grain. It was also best in preventing reinfection, but the results in this respect are disregarded for the present, because of what in the future may prove to be an irregularity.

Bluestone and Salt is tentatively recommended as a farmers' treatment for the prevention of "smut." For the present it is suggested that the solution be made of equal parts of bluestone and salt.

FUNGUSINE, though not quite fulfilling its description as "infallible," has proved in this trial to be very satisfactory. As a smut preventive it is not quite as good as bluestone, but rather better than bluestone and lime. It had absolutely no injurious effect upon the germination of the seed, but rather protected it from the attacks of unseen grain pests. For preventing reinfection it was not as good as bluestone, but very slightly better than bluestone and lime.

It was the best all round method tried this year, and if it maintains this position in future experiments it will displace bluestone in any form as the most satisfactory method for general adoption.

BORDEAUX MIXTURE did not prove satisfactory as a bunt preventive, nor in preventing reinfection. It had practically no injurious effect upon the vitality of the seed grain.

FORMALIN this year did not prove satisfactory in preventing smut, but this is considered due to an abnormal irregularity. It was of little value in preventing reinfection. In this trial, when the conditions for germination were good, it had practically no injurious effect upon the germination of the seed.

SALT-WATER proved unsatisfactory as a bunt preventive. It had not a very destructive effect upon the seed grain—in this respect it was about equal to that of bluestone and salt. This treatment may be considered as being entirely unsuitable and ineffective.

Seed may be treated with bluestone, bluestone and lime, or "Fungusine" at least three months before it is required for planting.

Insectivorous Birds of New South Wales.

[Continued from page 299.]

While the feeding habits of most Australian birds are pretty well known to ornithologists and to many bushmen from practical observation, it is only by scientific examination of the contents of the stomachs and crops, as soon as possible after feeding, that exact details of what they consume may be obtained. This work has been extensively carried out with American birds, many thousands of stomachs having been opened; and we have pleasure in publishing in this issue results of examination of the stomach contents of fifty-seven Australian birds, collected by Dr. J. Burton Cleland, Principal Assistant Microbiologist, Bureau of Microbiology. This is an excellent beginning, and we hope the work will be continued; but we must warn our readers not to draw hasty conclusions from the facts given. Not more than three specimens of any one bird have been examined, and in all cases it is possible that further investigations will vary in some degree the general results. The slaughter of a few birds for this scientific work will have no appreciable effect upon the numbers in the State, but the information obtained will be of great value to those whose interest it is to know their friends from their foes.

Two more plates from Gould's book are published in this issue, the Red-capped Robin and the Coachwhip.

3. Red-capped Robin.

The little dandy of the west country, always seeking some conspicuous position to show off his feathers. There is very little of real beauty in the dull green pine-clad plains of the far interior, and the Red-capped Robin is one of the few specimens of native fauna which present any attractive colouring—often, alas, making him the target for the western boy's catapult.

While the Red-capped Robin extends across the mountains, and even down on the coastal plains, it is found chiefly in the inland districts of the State, and is freely dispersed throughout the western portions of New South Wales, wherever there is any light timber or scrub. It extends through the drier parts of Victoria, South Australia, South Queensland, and Western Australia, but in the far north its place is taken by the Red-throated Robin (*Petrœca Ramsayi*). The male possesses the glowing scarlet cap and breast, and black coat, whilst the female has only a sprinkling of red feathers above the bill.

The nest is cup-shaped and exceedingly neat, composed of bark fibre, ornamented with pieces of lichen so as to resemble the branch on which it is placed. It is cosily lined inside with hair or fur, and usually placed low in the fork of a native pine tree or other low timber. The eggs, two or three to a sitting, are greyish-green, freckled with purplish brown, particularly towards the larger end. Breeding season, from middle of July to end of

December. Probably two or more broods are reared in a season. The Red-capped Robin is frequently the foster-parent of the Bronze Cuckoo, another insectivorous bird, the egg of which may be found in the nest.

Our arid interior presents a grand problem for the Australian people to solve. Efforts are being directed towards the production and selection of drought-resisting crops, and our engineers are devoting their best energies to the conservation of water. Step by step the boundary of the cultivated area is extending westward; but, unfortunately, crops and trees take their parasites with them, and insect pests are as troublesome west of the Great Divide as they are on the coast. Even the native saltbushes are periodically attacked by the Bugong Moth and other pests.

Your grandchildren, working small areas of orchards and crops under irrigation, or by dry farming, in the west, will look for assistance in controlling insect pests to the birds which nature gave to the Australian bush. Will you leave them no trace of the Red-capped Robin but a few stuffed specimens in museums, and a few ancient plates in this *Gazette* and scientific journals? We ask Australian boys to regard him as they do now commonly regard the Laughing Jackass and the Magpie—a valuable friend to this and future generations.

4. The Coachwhip Bird.

In some lights the head and chest of the bird shown in this plate have a purple tint. It is difficult to blend the colours in three-colour photography to produce a true black.

The Coachwhip may be found throughout Eastern Australia, particularly in the scrubs and brushes near the coast, and in the mountain gullies. The birds are rarely seen by casual observers except early in the morning, when they come out for an airing, retiring later to the dense undergrowth for the day, to live and sleep and find their insect food.

The vernacular name is derived from the peculiar call of the male, a few low, rapid notes, followed by a rising, hissing whistle, and ending in a loud, clear, vigorous "whip." The female will immediately answer "pit-wit-wee," so rapidly that one would think the notes came from the same bird. This is the female's intimation that "all's well." If she does not reply, the male will know that danger is nigh, and in his next call he will omit the crack, merely uttering the introduction.

The Coachwhip rarely takes to flight, but runs through the scrub like the Lyre Bird, which it greatly resembles in many of its habits. The length of the bird, including the tail, is about 10 inches.

The nest is open, somewhat loosely constructed of twigs, lined with rootlets and grasses, and usually placed in a low bush in the thick undergrowth, in a mass of climbing plants, or in the dead leafy top of a fallen gum sapling. Near Sydney the bird generally selects the blackthorn (*Bursaria spinosa*), whilst on the Northern rivers it may be found in a bunch of lawyer (*Calamus*) canes. The eggs are two, rarely three, in number for a sitting, bluish or greenish-white, sparingly spotted with irregular black markings.

This is one of our best insectivorous birds, but from its shy and retiring nature it seldom ventures into cultivated orchards. It is a valuable outpost to the farmer and orchardist, for if the Coachwhips were encouraged and allowed to become sufficiently numerous, the man on the land would have no need to fear that, after he had cleaned his holding of insect pests, he would be constantly in danger of invasion from the native scrubs. This is the function of the Coachwhip in the scheme of production, and his loud note should be as welcome to the settler as is the crack of the whip of his human prototype bringing the daily mail.

(*To be continued.*)

Trials of Imported Grasses.

In December, 1908, samples of imported grass seeds were sent by the Department of Agriculture to the Hawkesbury Agricultural College and the Grafton Experiment Farm for trial.

A sample from Java labelled "Paspalum" proved to be identical with the species *Paspalum dilatatum*, and one from Brazil marked "Favourita" turned out to be *Tricholæna rosea* (Natal Red Top). Although these seeds came from entirely different climates and from different soils, the plants showed no variation in growth.

Another grass from Brazil, *Melinis minutiflora*, did well at both the Hawkesbury Agricultural College and the Grafton Farm.

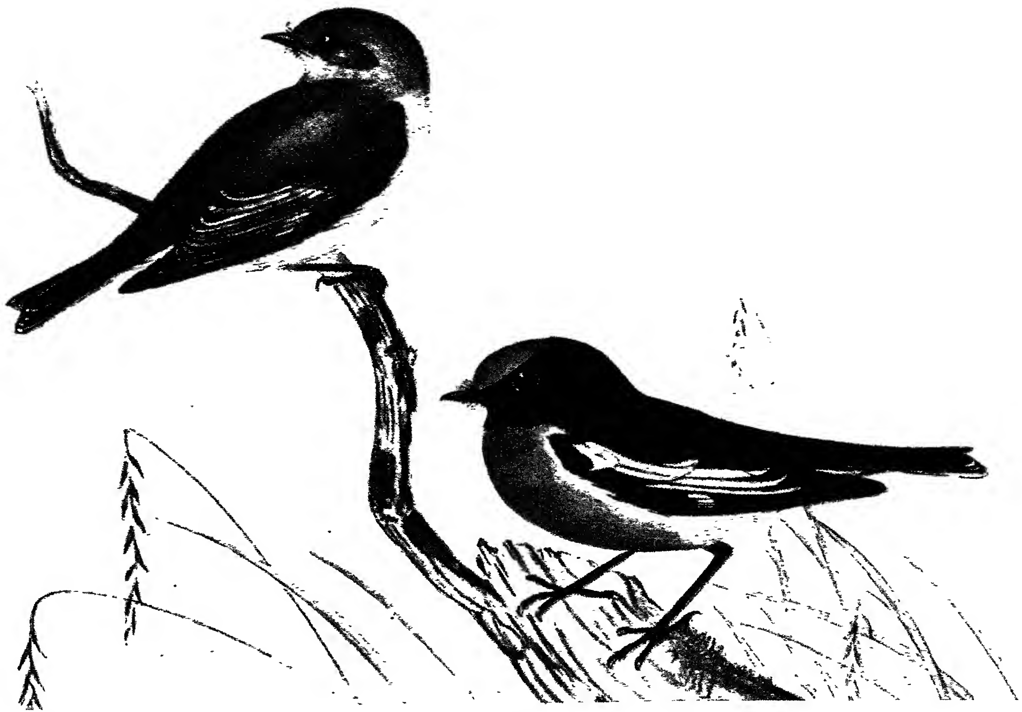
Mr. A. J. Pinn, Experimentalist at the College, reports:—

> This grass has grown to a height of 3 feet, and proves a dense, vigorous grower. The leaves are short, fairly broad, and of a light green colour. The stems are of a brownish hue, and, like the leaves, are rather hairy. It is a good drought resister, having stood the dry weather here particularly well.
>
> This grass is similar to *Tristegis glutinosa*, *Capim gordum* (Fat Grass), also from Brazil, which is said to be a splendid fodder for all classes of stock. The seed of this latter grass was sent by Mr. Harrison, Burringbar, Tweed River, through the Department.

Mr. A. H. Haywood, Manager of Grafton Experiment Farm, who also tried the grass *Melinis minutiflora*, sowed the seed on the 4th February, 1909, and it grew well. He reports that it appears to be a desirable summer grass, and is a perennial, giving rather a bulky amount of grass, which is very soft and velvety.

Red Hanneport Grapes.

Mr. W. J. Allen, Fruit Expert, has received from Mr. George Formby, of Somerville Orchard, Wombat, a very fine sample of Red Hanneport Grapes. Mr. Formby says the vines have carried a heavy crop. These grapes should find a ready sale on local and New Zealand markets.



INSECTIVOROUS BIRDS OF NEW SOUTH WALES.

"RED-CAPPED ROBIN."

PETRŒCA GOODENOVII, *Vig.* and *Horsf.*

Examination of Contents of Stomachs and Crops of Australian Birds.

J. BURTON CLELAND, M.D., Ch.M., Principal Assistant Microbiologist, Bureau of Microbiology.

THE following results of the examination of the stomach contents of fifty-seven birds may prove of interest. They are from specimens collected for scientific purposes by myself in 1909. In addition to an investigation of the food supply of birds, the skins were also of course preserved, the intestines and tissues were searched for parasitic worms, and blood-films made and examined for protozoa, such as *Halteridium*. A summary of the interesting discoveries in the latter two directions it is hoped will be available shortly. The utmost possible scientific use has, I believe, been made of every specimen of bird thus obtained.

I desire especially to thank W. W. Froggatt, Esq., Government Entomologist, and J. H. Maiden, Esq., Government Botanist, whose results so materially enhance the value of this paper, for their kindly assistance and co-operation.

M., followed by a numeral, indicates the number of the bird in Matthews' "Handlist of the Birds of Australasia," published as a supplement to "The Emu," Vol. 7, 1907–8.

H., followed by a numeral, indicates the number of the bird in Robert Hall's "A Key to the Birds of Australia and Tasmania," 1st Edition.

The uninitialled results are those obtained by myself while sorting the stomach contents for identification by an entomologist or botanist.

The initials "W.W.F." indicate that the following memorandum is the result of the examination of the insect remains by Walter W. Froggatt, Esq., F.L.S., Government Entomologist, New South Wales.

Similarly the initials "J.H.M." indicate the botanical results of an examination by J. H. Maiden, Esq., F.L.S., Government Botanist, New South Wales.

The date when shot is followed by the locality. When more than one specimen of a species has been examined, these are denoted by (*a*), (*b*), &c.

Family Charadriidæ.

Aegialitis ruficapilla. (M. 157; H. 614.) Red-capped Dottrel.

September, 1909, Perth.

Fragments of insects; a small beetle; some other animal fragments.

(W.W.F.)—Chiefly beetle remains; anal appendages of some beetle larvæ; a small weevil.

Family Cacatuidæ.

Psephotus hæmatorrhous. (M. 354; H. 517.) Crimson-bellied Parrakeet.
5th October, 1909, Moree.
Many seeds (*a*) small, yellow.
(*b*) larger, orange.
(*c*) long, narrow, whitish.
Fragments of stamens (?)
Fragments of charcoal (?), some floating.

Psephotus hæmatonotus. (M. 361; H. 524.) Red-backed Parrakeet.
(*a*) 13th July, 1909, Orange, N.S.W.
Crop shows a number of small yellow seeds. Some fragments of white seeds; some very small pieces of charcoal.
(J.H.M.)—The seeds were not identifiable.
(*b*) 13th July, 1909, Orange, N.S.W.
Crop distended with small purple seeds and slightly larger oval white ones (? both grasses).
(J.H.M.)—The seeds were not identifiable.

Family Cuculidæ.

Chalcococcyx plagosus. (M. 412; H. 462.) Bronze Cuckoo.
September, 1909, Perth.
Stomach lined by black hairs, mostly parallel to each other. Microscopically these have thorn-like processes projecting from the sides (? hairs of caterpillar). Rest of contents black and granular (fragments of hairs); three portions of a large insect (? caterpillar); a small piece of white quartz. Microscopically an oval egg and a number of curved brownish bodies of regular shape.
(W.W.F.)—These are chiefly the remains of "Woolly Bear" caterpillars, as the heads are also on the bundles of hairs and skin. The caterpillars are probably the larva of a *Darela.*

Family Muscicapidæ.

Micrœca fascinans. (M. 433; H. 86.) Brown Fly-catcher.
10th April, 1909, Sydney.
An ant, a ladybird, beetle's case, and remains of insects.

Petrœca rosea. (M. 443; H. 94.) Rose-breasted Robin.
11th June, 1909, Hawkesbury River.
Fragments of small beetles and insects; an ant.
(W.W.F.)—Several ants; small ground beetles, amongst them the elytra of a Clerid.

Rhipidura tricolor. (M. 487; H. 139.) Black and White Fantail.
(*a*) 7th June, 1909, Sydney.
Many fragments of insect wings, elytra, &c.
(W.W.F.)—Remains of small flies (Diptera).
(*b*) 10th April, Sydney.
Beetle cases in stomach.

Family Timeliidæ.

Psophodes crepitans. (M. 526; H. 223.) Coachwhip Bird.
17th April, 1909, Bulli, N.S.W.
(W.W.F.)—Remains of beetles of genus *Onthophagus* (fam. Scarabæidæ). Probably captured by the birds about fresh cowdung, on which the beetles feed.

Family Turdidæ.

Oreocicla lunulata. (M. 544; H. 160.) Mountain Thrush.
17th April, 1909, Bulli, N.S.W.
(W.W.F.)—Remains of some ground-living beetle. Species cannot be determined.

Family Sylviidae.

Origma rubricata. (M. 557; H. 185.) Rock Warbler.
(*a*) 11th June, 1909, Hawkesbury River.
A number of small seeds and parts of seeds of several kinds; a little sand.
(J.H.M.)—Seeds of Chenopodiaceæ; perhaps species of Chenopodium or Atriplex.
(*b*) 11th June, 1909, Hawkesbury River.
Several brownish purse-shaped seeds and some smaller white ones. No insect remains.

Acanthiza reguloides. (M. 575; H. 197.) Buff-rumped Tit.
10th April, 1909, Sydney. Beetles' cases, &c.

Malurus cyanochlamys. (M. 593; H. 117.) Blue Wren.
(*a*) 13th July, 1909, Orange, N.S.W.
Numerous elytra of small beetles (?).
(W.W.F.)—Remains of ants (*Ectatomma metallicum*); elytra of small Chrysomalid beetles.
(*b*) 13th July, 1909, Orange, N.S.W.
Numerous fragments of small beetles (?).
(W.W.F.)—Remains of small beetles and ants.

Malurus lamberti. (M. 602; H. 125.) Variegated Wren.
26th October, 1909, Hawkesbury River.
Broken fragments of beetles.
(W.W.F.)—Remains of very small beetles.

Family Prionopidæ.

Collyriocichla harmonica. (M. 636: H. 68.) Grey Shrike-thrush.
(*a*) 7th June, 1909, Sydney.
Elytra, &c., of several insects.
(W.W.F.)—Chrysomalid beetles; remains of grasshopper.
(*b*) 26th October, 1909, Hawkesbury River.
A large green-with-gold-spots grub, 1½ inches long; portion of a grasshopper? Carapaces, legs, &c., of several large beetles. Several small pale blue eggs.
(W.W.F.)—Caterpillar of large Hawkmoth, *Cequosia triangularis;* Banksia moth, *Danima banksiæ;* looper caterpillar; beetles—*Elator* sp., *Alicula* sp., and other undeterminable species; remains of grasshopper or locust.

Grallina picata. (M. 646; H. 67.) Magpie Lark.
7th June, 1909, Sydney.
Some brown pieces of maize seed; two seeds of wheat; one small fly; several small beetles, almost complete; many fragments of insects.
(W.W.F.)—Fragments of wheat and maize; remains of beetles and small flies; green-head ant.

Family Laniidæ.

Gymnorhina tibicen. (M. 647; H. 243.) Black-backed Magpie.
21st May, 1909, Berry, N.S.W.
(W.W.F.)—Wheat and plant remains; several ground beetles; green-head ants (*Ectatomma metallicum*).

Falcunculus frontatus. (M. 660; H. 256.) Yellow-bellied Shrike-tit.
20th October, 1909, Tamworth.
Many fragments of insects; metallic elytra of beetles.
(W.W.F.)—Remains of Lamellicorn beetles; remains of Chrysomalid beetles.

Pachycephala pectoralis. (M. 667; H. 265.) White-throated Thickhead.
13th June, 1909, Hawkesbury River, N.S.W.
Two larvæ of saw-flies; remains of a large grasshopper (?).
(W.W.F.)—Chiefly saw-fly larvæ. *Perya* sp. (three specimens), *Pterogophorus* sp.

Pachycephala rufiventris. (M. 674; H. 271.) Rufous-breasted Thickhead.
(*a*) 26th October, 1909, Hawkesbury River.
Metallic-tinted fragments of beetles; two hymenopterous (? dipterous) insects.
(W.W.F.)——Wing case *Stigmodera* sp. (Coleoptera); Chrysomalid and ground beetles (Coleoptera); small frog hopper (Homoptera).
(*b*) 20th October, 1909, Tamworth.
Many fragments of beetles; a small fly or hymenopterous insect; a bug (?); a pupa or grub (?).
(W.W.F.)—Beetle remains. Chiefly small heteromera found among foliage. Saw no grub or fly in this stomach.

Eopsaltria australis. (M. 683; H. 259.) Yellow-breasted Shrike-robin.
(*a*) 8th May, 1909, Sydney.
An ant; a small beetle; some fragments of insects; fifteen oval reddish seeds, a little smaller than wheat seeds.
(W.W.F.)—Chief food, green-head ants (*Ectatomma metallicum*).
(J.H.M.)—The seeds are those of a Leucopogon probably. They are certainly from an Epacridaceous plant.
(*b*) Sydney.
(W.W.F.)—Chiefly the remains of the green-head ant (*Ectatomma metallicum*).

Family Zosteropidæ.

Zosterops Gouldi. (M. 709; H. 303.) Green-backed Silver-eye.
September, 1909, Perth.
Some fragments of insects; part of a large grub (?); some fragments of green vegetable matter.
(W.W.F.)—Beetle remains; various insect remains.

Family Dicæidæ.

Pardalotus punctatus. (M. 726; H. 379.) Spotted Pardalote (Diamond Bird).
(*a*) 11th June, 1909, Hawkesbury River, N.S.W.
Fragments of small beetles, &c.
(W.W.F.)—One thrips; beetle remains; floating scales may be those of Aphis.
(*b*) 11th June, 1909, Hawkesbury River, N.S.W.
Small fragments of insects.
(W.W.F.)—Undefinable. Oil and scales suggest that the bird had been feeding upon cutworm moths (*Agrotis* sp.) or aphis.

Family Meliphagidæ (Honey-eaters).

Melithreptus atricapillus. (M. 733; H. 307.) Lunulated Honey-eater.
(*a*) 24th July, 1909, Sydney.
Wings, elytra, antennæ, &c., of insects—many fragments.
(W.W.F.)—Thrips; remains of elytra of ground beetles.
(*b*) 24th July, Sydney.
Wings, antennæ, and many insect remains; a small fly.
(W.W.F.)—Some perfect specimens of thrips; diptera, several species; beetles.
Melithreptus brevirostris. (M. 741; H. 313.) Short-billed Honey-eater.
(*a*) 21st August, 1909, Sydney.
A grub; fragments of insects' bodies and wings.
(W.W.F.)—Larva of moth and remains of ground beetles.
(*b*) 8th May, 1909, Sydney.
(W.W.F.)—Jaws of spider; remains of beetle larvæ.
(*c*) 2nd April, 1909, Sydney.
(W.W.F.)—Larva of Lamellicorn beetle.
Acanthorhynchus tenuirostris. (M. 752; H. 299.) Spine-billed Honey-eater.
8th May, 1909, Sydney.
(W.W.F.)—Chiefly the remains of house flies (*Musca domestica* or *Musca corvina*).
Meliphaga phrygia. (M. 764; H. 327.) Warty-faced Honey-eater.
3rd April, 1909, Hawkesbury River, N.S.W.
Stomach full of elytra, legs, &c., of beetles.
Stigmatops ocularis. (M. 765; H. 320.) Brown Honey-eater.
September, 1909, Perth.
A few fragments of insects (wings, &c.).
(W.W.F.)—Chiefly remains of small diptera; a few fragments of beetles; small homoptera.
Ptilotis chrusotis. (M. 770; H. 329.) Yellow-eared Honey-eater.
12th June, 1909, Hawkesbury River, N.S.W.
A fleshy purple fruit.
(J.H.M.)—Fruit of *Phytolacca decandra*, Linn. (Red-ink Plant).
Ptilotis chrysops. (M. 775; H. 336). Yellow-faced Honey-eater.
(*a*) 24th April, 1909, Sydney.
(W.W.F.)—Remains of diptera (one *Culicidæ*, *Culex* sp.; one *Muscidæ*).
(*b*) 24th July, 1909, Sydney.
A few fragments of insects.
(W.W.F.)—Remains of flies and beetles.
(*c*) 3rd April, 1909, Sydney.
Beetle bodies.
Ptilotis leucotis. (M. 778; H. 339.) White-eared Honey-eater.
(*a*) 12th June, 1909, Hawkesbury River, N.S.W.
A beetle case; some remains of other insects.
(W.W.F.)—Chrysomalid beetle; heads of small ants.
(*b*) 26th October, 1909, Hawkesbury River, N.S.W.
Fragments of beetles; three eggs like ant eggs.
(W.W.F.)—Fragments of beetles.

Ptilotis melanops. (M. 781; H. 342.) Yellow-tufted Honey-eater.
3rd April, 1909, Hawkesbury River, N.S.W.
Beetles.

Ptilotis penicillata. (M. 791; H. 346.) White-plumed Honey-eater.
13th July, 1909, Orange, N.S.W.
Numerous fragments of insects.
(W.W.F.)—Insect remains. Nothing distinctive except fragments of beetles.

Ptilotis plumula. (M. 787; H. 349.) Yellow-fronted (Plumed) Honey-eater.
September, 1909, Perth.
Some fragments of insects and case of small beetle.
(W.W.F.)—Also remains of spider.

Meliornis novæ-hollandiæ. (M. 799; H. 354.) New Holland Honey-eater.
(*a*) 24th April, 1909, Sydney.
(W.W.F.)—Remains of two flies (Diptera), appear to have been Syrphidæ.
(*b*) 2nd August, 1909, Sydney.
Wings and part of body of large fly (?); some other remains of insects.
(W.W.F.)—Chiefly remains of various species of flies.

Meliornis sericea. (M. 801; H. 356.) White-cheeked Honey-eater.
24th April, 1909, Sydney.
(W.W.F.)—The remains of several flies (Diptera), much decomposed; species appear to belong to family Muscidæ.

Myzantha garrula. (M. 804; H. 360.) Noisy Minah.
13th July, 1909, Orange, N.S.W.
A few fragments of insects (legs, elytra, &c.).
(W.W.F.)—Remains of beetles (Heteromera, &c.).

Myzantha flavigula. (M. 806; H. 361.) Yellow-throated Minah.
5th October, 1909, Moree.
Fragments of beetles and other insects; ? remains of grubs; several small yellowish kidney-shaped seeds.
(W.W.F.)—1. Crane fly (Tipulidæ) Diptera; 2. Remains of cutworms (*Agrotis* sp.); 3. Beetles (Heretomera).

Tropidorhynchus corniculatus. (M. 816; H. 370.) Friar Bird, Leatherhead.
3rd April, 1909, Hawkesbury River, N.S.W.
One dipterous insect; seeds.

Family Oriolidæ.

Oriolus sagittarius. (M. 850; H. 62.) Oriole.
3rd April, 1909, Hawkesbury River, N.S.W.
Exocarpos (?) fruits; red seeds.

Family Corvidæ.

Corcorax melanorhampus. (M. 883; H. 54.) White-winged Chough.
21st May, 1909, Berry, N.S.W.
When shot discharged a carnation-coloured fluid from anus and mouth, and the abdominal organs were similarly deeply tinted. This was due to the bird feeding on the fruit of the Red-ink Plant (*Phytolacca decandra,* Linn.).
(W.W.F.)—A cut-worm (*Agrotis* sp.); beetles (*Paropsis*) and other beetle remains; a quantity of black seeds.

Introduced Birds.

Passer domesticus. (Sparrow.)
Richmond, N.S.W.
About a dozen very small black seeds; part of a maize (?) seed; fragments of other grains; no insect remains.
(J.H.M.)—Seeds of a plant belonging to *Amarantaceæ*, probably a species of *Amarantus.*

Sterna vulgaris. (Starling.)
21st May, 1909, Berry, N.S.W.
(W.W.F.)—Remains of one earwig (Forficulidæ); one spider, two flies (Diptera), and one beetle (*Chrysomalidæ*).

The Banded Pumpkin Beetle.

(*Aulacophora oliverei*, *Guérin*.)

WALTER W. FROGGATT.

During the last season, on account of the luxuriant growth of all vegetation, foliage-eating pests have been very abundant, and in all districts where pumpkins and melons are grown, the pumpkin beetles have been very numerous and destructive. Last year I published an illustrated account of this beetle, and pointed out that though the beetles laid their eggs in captivity and they hatched out, we could not rear the baby grubs in captivity for want of the natural food.

Last December Inspector Gallard noticed a bed of pumpkins, owned by Mr. Coull at Narara, dying off in a curious manner, and was told by the owner that he had found small white grubs at the base of the stem and feeding on the roots. With the owner's permission, Mr. Gallard placed the field under observation, and dug up and examined many roots and the surrounding soil, with the result that he obtained a complete series of the larvæ and pupæ of the pumpkin beetle, which until now had remained unidentified.

The larvæ or grubs are slender, cylindrical creatures, about four-tenths of an inch in length, of a uniform dull whitish tint, furnished with a small dark brown head, lobed on the summit and rounded in front to the short incurved jaws. The antennæ, tubercles, and palpi are short and thick set. The three pairs of legs are short and rather small, mottled with brown. The anal segment has the dorsal surface covered with a curious dark blotch, shading from brown to black, and forming a rounded plate pierced with a number of circular white holes, so that it resembles a fine grating with a light showing through. This blotch is furnished with two short black spines at the apical edge.

These larvæ are active little creatures, feeding upon the stem and roots of the pumpkin vines, sometimes gnawing their way into the base of the stem. When full grown they pupate at a distance varying from 1 to 6 inches beneath the surface, simply forming a chamber in the damp soil, in which they undergo their transformation.

The pupa is of the usual form of this group of the chrysomelid beetles, with the head and portion of the thorax curved over towards the base of the abdomen, the folded-wing cases standing out on either side, and the legs folded down on the sides. The abdominal segments are covered with short, scattered hairs, terminating in a tuft at the tip of the anal segment, which is furnished with two curious spine-like appendages. These appendages are white and broad at the base, but black and tapering into a spine at the extremity.

When full grown, the pupal skin cracks, and the perfect beetle emerges and works its way up to the surface, ready to make a fresh attack upon the surrounding vegetation.

Mr. Gallard commenced his observations in the middle of December, and from then to the middle of February found all stages of larvæ, pupæ, and beetles in the soil. Though the exact time occupied in each stage of existence has not been definitely fixed, the investigations are very interesting, as they give some idea of how to deal with the melon patches after the crop has been gathered.

If all dead pumpkin and melon plants are cleaned up and burnt with all the surface rubbish on the ground, the hibernating beetles and their eggs will be destroyed.

If the soil is turned over early in the season and thoroughly disturbed, most of the delicate larvæ and pupæ in the soil will be destroyed.

Growing pumpkins and melons where these plants had not been grown the previous year would also be advisable.

As in many other cases, clean cultivation will do much to reduce this pest, but it must be general throughout the infested districts.

Naturalised Flora of South Australia

The spreading of many a noxious weed would be prevented if every man on the land were possessed of sufficient botanical knowledge to recognise the plant and its nature on its first appearance in the district. Unfortunately, however, it is often very difficult for those whose training and occupation are interwoven with economic agriculture to readily obtain the necessary information. A long-felt want in this State is a book dealing with these injurious and sometimes poisonous weeds in popular language. Botany, however, is an exact science, and its terminology is not such as can be readily expressed in unscientific language without injuring the value of the information supplied.

A large measure of help comes to us from a sister State in "The Naturalised Flora of South Australia," by J. M. Black, of Norwood, Adelaide. It is a little work of some 200 pages in handy form, with 206 illustrations, from which the plants may be identified. The glossary of botanical terms and the key to the families will be found of great assistance to those who have not even a superficial knowledge of botany, and a perusal of the book generally will, it is believed, introduce many of our readers to an acquaintance with this most interesting branch of the study of nature.

Mr. J. H. Maiden, Government Botanist, informs us that he has tested the book by use and finds it valuable; most of the weeds figured therein, unfortunately, also occur in New South Wales.

Australian Dairying.

Water in Butter.

M. A. O'CALLAGHAN.

The long-expected has happened at last, and Australian butter has just received an unenviable advertisement throughout the trading world, by reason of a prosecution brought by English Customs officials during the first week in April, against Messrs. Ellis and Kislingbury, butter merchants, for having imported by the R.M.S. "Omrah," 33 cwt. of Australian butter, which contained 18·2 per cent of water.

A fine of 40s. was imposed, and no doubt a lenient view was taken by the magistrate because of the nature of the defence, namely, that the Government certificate which accompanied the butter did not mention anything about excess water. The magistrate remarked that the people who inspected the butter, and passed it for export, ought to have been before him, thereby implying that if they had been, the penalty would have been a much severer one.

The Melbourne correspondent of the *Sydney Morning Herald* states that similar complaints are being made in London regarding Victorian butters sent in the s.s. "Mooltan," and one firm who had complained had given analytical particulars of six brands of butter which they state are above the standard. This latter may or may not be true. It is difficult to take any hearsay evidence of this kind as being absolutely accurate, but no doubt if there is any truth in it, more will be heard of the matter. Sufficient harm has, however, been done, and our competitors throughout the world will, no doubt, take full advantage of the Victorian indiscretion, and point out the advantages which wholesale and retail merchants will have by the handling of butter that guarantees them from any risk of prosecution through any form of adulteration.

The Commerce Act.

Prior to the putting into force of the Commonwealth Commerce Act in 1906, there was no Act in New South Wales which authorised a supervision over the export of butter, and as far as we were concerned, there was nothing to prevent a man shipping butter with 30 per cent. of water, or for that matter with 30 per cent. of casein. Fortunately, perhaps, for us, the Australian Commerce Act was passed and put into operation a couple of years before the British standard for water in butter was definitely fixed. During the first season, a fair amount of trouble was given to the inspectors in New South Wales through the submission for export of butter containing evidence of too much water.

Value of Education.

Since then, however, our factory managers and butter makers have had a double education through the Commonwealth and the State in the question of water in butter. The analytical checks which have been kept on butter exports through the Commonwealth Commerce Act, and the penalties which have been inflicted by the Customs authorities here whenever a factory repeated the offence of "excess moisture," have had a very strong educational influence; and this education has been driven home to a great extent by the State, through the Dairy Instructors and the Dairy Branch generally, because whatever other people may think about the advisability of manufacturing butter containing a high percentage of water, the Dairy Branch of the Department of Agriculture has always discountenanced and discouraged any efforts in this direction.

The Dairy Science Schools,

which have been held at different centres throughout the State, and which have been largely attended by factory managers and butter makers, have brought so many of our manufacturers up-to-date in their knowledge of the scientific manufacture of butter, and their knowledge of the proper method of determining the amount of water in butter, that we have had very little trouble of late in the way of butter approaching the danger mark of moisture content. It will be remembered by those interested that the Dairy Science Schools referred to had on the teaching staff a chemist and a bacteriologist, and each manager was given a coaching in the easy methods of estimating the water contents of a butter.

The Butter Faker *versus* the Manufacturer.

New Zealand especially, and, in fact, Australasia generally, had obtained an enviable reputation for the sending of butter of *low moisture* content for sale on British markets, but when it became common knowledge that a class of trader had sprung up in England, known as the "butter faker," whose business consisted in the purchase of dry butters, and the addition of moisture thereto by reworking same, the butter being eventually sold at large profits by the "faker," many of our factory managers turned their attention to the question as to whether it would not pay them better to manufacture a butter containing a high percentage of water, and thereby obtain some of the profits of the "faker" for themselves.

In a paper which I read at the "Factory Managers' Conference" held in Sydney last year, I drew attention to the danger of manufacturing a butter containing a high percentage of water, and therein I stated as follows:—

Water *versus* Law.

It was not until recently that the English Government passed regulations governing the percentage of water which should be allowed in butter. Now they have fixed a standard of 16 per cent., and a check is being kept on the imports with a view to prosecuting offending importers.

So far Australian exporters have not, as far as we know, been before the English Court for excess water; but there is no doubt whatever that but for the timely intervention of the Commerce Act, a great many cases would have been filed against importers of Australian butters.

When the Commerce Act was put into force three years ago, excess water in butter was common. Now, I am pleased to say, very few cases crop up.

Evidently some managers in the sister State have not paid sufficient attention to the question of manufacture, or else they have knowingly endeavoured to obtain more than a legal amount of the "faker's" profit—in other words, they have met the English "butter faker" at his own game, and have adopted the policy of straining the limit and running the gauntlet.

The English Customs authorities have intervened, with, I am afraid, disastrous results to the profits of the would-be "faker" of Australian butter in Australia. In England, faking can still go on to a certain extent, but the butter so faked has to be sold under a special name, according to law, and must not contain more than 24 per cent of water.

Water *versus* Quality.

Factory managers should bear in mind that the more water the average food product contains the quicker will be the bacterial development, and also the less will be the preservative influence of a given per cent. of a substance like boric acid.

Another point which should be remembered is that, on being thawed, the butter with a high percentage of water will go bad more rapidly than that with a low percentage. Here, again, bacterial activity under fairly high temperatures is the chief factor.

I think all managers should aim at producing a butter which contains not more than 14 per cent. of water, which is the limit under the Commerce Act for butter of *superfine quality.*

Another point in connection with this water question is, that it will be very difficult for a manager, who is working on irregular water contents, to say how much preservative he can safely add to his butter. If he allows 16 per cent. of water in his butter one week, and only 12 the next, and, say he adds $\frac{3}{4}$ per cent. of preservative in the first instance, he may find that he has exceeded, in the case of the 16 per cent. butter, the standard which the law allows for boron preservatives.

The Question of Supervision.

There are people within the State who fought strenuously against the introduction of the Commerce Act, and it should now be evident to those people how great was their folly. Had not the Commerce Act been introduced, what check would there have been on the export of New South Wales butter? I will go further, therefore, and say that we are at the present time, to a certain extent, living in a "fool's paradise," and I shall not be surprised, if at any time the cables should announce the fact that Australian butter has been found to contain foreign fat, or in other words, to have been adulterated with margarine before the butter was exported.

Whom to Blame.

No doubt the inspector under the Commerce Act will be blamed, because he has not been able to examine every box of butter, both analytically and otherwise. The blame, however, should rest on other shoulders. All people of experience know that it is impossible to examine more than a certain percentage of the butter that is being exported, and that when a large line of butter is submitted for export, it is quite possible that samples may be taken and still the adulterated article escape detection. Possibly only 50 per cent. was adulterated, and the inspector was not lucky enough to sample the affected portion.

What is Wanted

is, a better system of inspection and control of manufacture, rather than a closer supervision of exports. The individual factory must do the adulteration, and here is where the matter can be efficiently controlled.

I pointed this out very fully in an article on margarine, which was published in the October, 1909, issue of this *Gazette*. At the present time, a number of people hold the opinion that, since colouring matter has been prevented in the manufacture of margarine in this State, there is not much fear of adulteration; but there is no folly so great as that of the man who is living in a self-satisfied atmosphere, with an unknown sword hanging over his head. The prevention of colouring matter in margarine only compels the margarine "faker" to find room for his energy in another direction, and a channel is close to his hand in the way of butter for export and for local sale. There is nothing whatever to prevent him purchasing a good butter of deep colour, and adding thereto about 20 per cent. of margarine and exporting same to England, where the rather light colour of the mixture will add to its selling possibilities rather than detract therefrom. No doubt the stable door will be closed when the horse named "Purity" has got out.

The table given on page 412 shows clearly the New South Wales position, as far as the question of water in butter is concerned.

All the butters that exceeded 16 per cent. of water were stopped from export.

Probably the best general information which we can supply regarding our butter this year is that given by the London correspondent of the *Sydney Morning Herald* on the 22nd March, 1910, as follows:—

Still of improving quality is New South Wales butter, and it is doubtful whether the State ever shipped a better lot than came in the "Orsova." Traces of heat were at a minimum, and fishiness was almost absent. Experts, in fact, look upon it as one of the most satisfactory ever made from Australia. All round this season, however, there has been almost complete absence of complaints. Some slight exceptions to this do not in any way detract from the position now attained. There always will be some complainers and fault-finders. New South Wales butters now occupy a higher position than ever before. In the past twelve months *only one complaint has been made, for instance,* as to the excessive moisture in the State's butter. On analyses being offered free, the dissatisfied buyer did not think it worth while to bother further.

WATER in Export Butters—Season 1909–10.

Month.	Samples examined for Month, and Monthly Average.	Under 10 %		Under 11 %		Under 12 %		Under 13 %		Under 14 %		Under 15 %		Under 16 %		Over 16 %	
		No.	Average.	No.	Average.	No.	Average.	No.	Average.	No.	Average.	No.	Average.	No.	Average.	No.	Average.
1909.																	
September	106 av. 14·93 %	3	9·83	7	10·66	12	11 66	22	12·61	43	13·48	14	14·47	4	15·42	1	17·30
October...	347 av. 13·00 %	6	9·39	20	10·59	38	11·50	96	12·51	110	13·43	66	14·42	9	15·32	2	18·92
November	121 av. 12·33 %	4	9·42	13	10·51	24	11·52	44	12·50	28	13·39	7	14·40	1	15·40	...	......
December	22 av. 13·61 %	...	......	..	......	3	11·39	7	12·59	6	13·48	3	14·28	1	15·27	2	19·13
1910.																	
January	86 av. 13·55 %	...	......	4	10·42	11	11·72	15	12·62	23	13·49	22	14·48	8	15·53	3	17·50
February	72 av. 13·49 %	2	8·64	...	......	9	11·44	20	12 47	24	13·57	7	14·54	4	15·09	*6	19 01
March	20 av. 13·57 %	...	... ..	1	10·98	1	11·52	3	12·64	9	13·39	2	14·19	4	15·51	...	......

*Of these six samples, three were taken from the one consignment, and two from another, there being only three consignments submitted in February which tested higher than 16 per cent.

Average of 774 samples examined in seven months, 13·30.

This is a very flattering position for New South Wales butter to occupy, and all concerned should be satisfied that a distinct improvement has taken place in our butters, despite any statement to the contrary made for trade purposes. Our factory managers have only to persevere in their endeavour to bring about a strict grading of cream at all factories, and our butters will continue to improve.

The following explanation furnished by the Superintendent of Exports, Melbourne, is taken from a recent issue of the *Argus*:—

Challenged Butter.

Certificate Misunderstood.

The Superintendent of Exports (Mr. Crowe) has supplied the Secretary for Agriculture (Mr. Duffus) with a report upon the recent London case, in which a firm of merchants was fined for having imported some Victorian butter containing an excess of water beyond the legal limit of 16 per cent. In this Mr. Crowe points out that the official certificate sent with butter to Europe refers to quality only, being the result of an examination for flavour, texture, and condition, and having no reference to composition. It is not issued as a result of analysis. If the certificate is to be regarded as misleading —and the magistrate in this case appeared to think the certificate should guarantee freedom from excess of water—Mr. Crowe suggests that it might be well to print on the document an exact statement of the limitations to the guarantee it gives.

Victoria, Mr. Crowe declares, has an official analysis made of a greater proportion of the butter it sends away than any other butter-exporting country in the world. During the export season just closed 1,399 samples out of a total of 546,190 boxes exported from Victoria were analysed prior to shipment. Mr. Crowe, in his report, says:—

"Samples of all consignments which, upon examination, appear to contain more than 16 per cent. moisture are taken and submitted to the Federal Analyst. In addition, samples are methodically taken so as to include every brand exported during the season. This is done so as to have an analysis of all butters at intervals, and particular attention is paid to those found to approach the maximum of 16 per cent. allowed under the Commerce Act regulations standard and the standard adopted in Great Britain. There are instances sometimes in which the analysis does not correspond with the condition and texture of the butter. Under certain conditions butter fat has a greater affinity for moisture, and holds it without showing any. Upon examination it appears dry, and of normal composition, and the analysis discloses the presence of a high moisture content. This experience, however, is exceptional."

Method of Preventing Rabbits from attacking Wheat and other Crops.

In the *Gazette* for August, 1909, page 729, reference was made to a practice of several selectors in the Monaro district of sowing a strip of rye around wheat and oat crops to keep away rabbits.

The Department of Agriculture would be glad to receive reports of any trials of this method which may have been carried out by our readers.

Book-keeping for Farmers.

P. G. GILDER, English Master, Hawkesbury Agricultural College.

THOUGH there are many text-books on general book-keeping, the fact that so far there is no particular work which can be recommended to our College students and to the farmers of the Winter Schools may be some justification for this slight sketch of the subject as adapted to agricultural conditions. English methods are somewhat too elaborate, and, the farms being usually leased, involve many transfers of rights in growing crops, manures, &c., which become confusing to those unacquainted with their systems of tenure. American treatises, whilst much simpler and better adapted to Australian conditions, become difficult to grasp owing to the difference in currency and to several slight alterations in detail.

Book-keeping on the Farm—its Importance.

Every farmer is impressed with the paramount necessity of keeping correct accounts, but the difficulty lies in the choice of a suitable method, easily grasped and capable of being carried out with a minimum of attention and of preliminary training. One's sympathies must always be extended to the man who, after a long day's work in the field, sits down to figure out some calculation, difficult to him under any circumstances, but doubly so owing to the methods employed.

Its Difficulty.

Though many people apparently think otherwise, it must be admitted that farm accounts, to be really useful, are by no means easy to keep, inasmuch as many of the entries must necessarily be estimates rather than statements of actual transactions. The operations of each branch are so dovetailed into the others that it is a matter requiring keen discrimination to ascertain the percentage of profit or loss to be allocated to them.

But however difficult they may appear to be, it should be remembered that an actual knowledge of his financial standing is as important an object to the farmer as the state of his crops. The conditions of agriculture have changed, things are cut much finer, competition is keener, and details of leakages must be watched far more closely than was necessary in the so-called "good old days." It is an age when brain must supplement, if it does not replace, brawn, and success is far more likely to attend the steps of the farmer who does not neglect this vital accompaniment of his operations.

Reasons for Keeping Accounts.

The following summarises the reasons for keeping accounts in business-like fashion:—

1. Because it is our only way of knowing whether the farm is being run at a good profit, at a small profit, or at a loss.

2. It enables us to trace the profit or loss to a certain department of the business—*e.g.*, the expenses may be too high, the live stock may not be paying for their keep, a certain crop may be grown at a loss, or perhaps one is paying well and another is not, but the whole balances, and we have no knowledge where the leakage or the profit is located: all these things will be told by a set of books such as every farmer can and should keep.
3. It tends towards economy of expenditure by keeping one's expense account continually in view, and may reveal to the farmer who is discouraged because his "farm doesn't pay," the fact that it is paying well, but the profits are all consumed by extravagant management or living expenses.
4. It enables us to eliminate the sources of loss by abandoning or improving those branches of agriculture which for us are conducted without profit, and to throw all our energies into those branches that show the greatest margin of profit.
5. It makes a handy compendium of particulars—a diary, a memorandum, a reference as to dates and crops, profits and transactions—which will be a source of much satisfaction and may become important evidence in case of litigation, or may even prevent it by furnishing indisputable proofs.

In addition, attention is directed to excessive expenses or to possible economies. Small items often amount to a considerable total and this attracts attention in a way that individual items would fail to do. In this connection it may be doubted whether many farmers, except those who keep regular books, have any definite knowledge in regard to the amount of their private expenses or cost of living. Their business and private moneys are rarely kept separate, and in many cases what is left over after the business and private expenses have been met is looked upon as representing the whole of the profits from farming. Undoubtedly many farmers are securing larger profits than they themselves realise, owing to their private expenses being in excess of what they estimate.

Preliminary Considerations.

It is first necessary to lay down a few definite rules before going into details. Many systems premise a clear line of demarcation between the farm proper and the house, practically on the basis that to ascertain the actual profits of a farmer as compared with those of a merchant or a professional man, the two must be kept very distinct. Though this is only the logical outcome of any correct system, the constant analysis of all accounts makes it undesirable for at least the first few years of a beginner's career in book-keeping.

Again, one of two aspects of the profit assessment may be chosen. The first is to charge the business with the owner's estimated salary and treat the total net return as a direct interest on the capital invested—*e.g.*, if, after

paying all expenses (including salary of say £200), a profit of £160 is made on a capital of £1,600, 10 per cent. per annum has been earned.

The second method is to charge the market rates of interest on the capital invested (*i.e.*, treat the owner's interest in the farm in exactly the same way as if it were a loan) and take the balance as net income for the year. Using the same figures as before in this case, 5 per cent. per annum on £1,600 would be £80, and the net profit is, therefore, £360 less £80 interest, or £280, which is the farmer's payment for time, trouble, and experience. In each case the total income is the same; but inasmuch as he would have received the 5 per cent. on his capital as a mere investment without labour, and as any allocation for salary can only be assumption, the second of the two systems is perhaps the more desirable.

In the case of a partnership, where the two or more parties are of unequal experience, or where one is not taking an active part in the business, the question assumes a different aspect and must be decided on its merits.

A popular suggestion for treating farm accounts is to take each of the paddocks separately, debit its proportion of rent, labour, seed, manure, &c., and credit the net returns. This, though possible to a skilled accountant, and perhaps comparatively easy where the crop occupies the ground the major part of the year, should rather be discouraged, especially when dealing with mixed farming, as it involves so many mere approximations and estimates. Probably the only instances where it is directly beneficial are either in conjunction with experiment plots, when accuracy in the seed and manure used and in the yield obtained is imperative, or where a farm of only three or four paddocks is confined to one crop and each is dealt with at one time.

Simplifying the Work,

The following suggestions may assist in simplifying the work at the outset:—

1. The house, farm, buildings, &c., may be treated as one property, whether rented or owned by the farmer, unless the house (as in a few cases) is detached from the farm and forms a separate property.
2. No salary is drawn by the owner or his family for services rendered. All farm products used by the household need not be charged, but all definite expenses incurred debited to a house account.
3. Interest charged on capital invested at 5 per cent. per annum, and any further profit is his net return.
4. Inasmuch as few farmers have many cash or bank transactions, the cash book may be dispensed with to reduce the number of books required. All entries may then be made through the journal.

The First Essential—an Inventory.

The man who starts a system of book-keeping with his capital in cash, and then purchases the farm, stock, &c., has a much simpler task than the one who for years perhaps has been engaged on the land. The latter must,

as a preliminary, "take stock,"—*i.e.*, discover what he is worth at any particular time. The season of the year for inaugurating the system needs some judgment. Other things being equal, January 1st or July 1st would be the best; but with certain classes of farming, this might be inconvenient. For instance, the end of March might be most suitable for a wheat-grower, as in December he would have wheat unsold, or even unharvested. The end of September might be best adapted for a summer fruit and citrus orchardist, inasmuch as that would probably be the only time when there was no fruit for sale. A tenant farmer would probably find it better to take his inventory on the anniversary of the day he entered into occupation, and the holders of conditional purchases and homestead selections on one of the dates on which their payments became due. Low stocks and slackness of work may govern other cases.

In making this valuation, much judgment must be exercised, and this in turn will tend to develop the business faculty. The memory will be called upon, old receipts and pass books looked up, and current values considered, to ensure some amount of accuracy. Over-sanguine estimates may, in some cases be made, but a wide-awake farmer usually gathers from the prices obtained at local auction sales, &c., a very fair idea of values.

Numberless instances might be given of the problems which confront the farmer at such a time. For instance, with the financial year closing on June 30th, he has several tons of seed potatoes intended for his own planting next season. To buy them would cost £6 per ton; whereas if sold they would realise but £4 or £4 10s. per ton. At what should they be valued? As an enhancement of the value in the "growing" year means a lowering of profit in the "sowing" year, the middle course would be wisest, with a strong leaning towards a low estimate.

The list must then be classified under separate headings, of which the following are the most important:—

1. Land (either with or without house, buildings, &c., which, with fences, dams, clearing, &c., may be placed under the heading of "improvements"). If the place has been bought as a going concern, with the house built and fences erected, the one account will suffice; but if unimproved land is obtained, and the additions made subsequently, two or even more divisions would be preferable.

2. Live stock, including horses, cattle, sheep, pigs, and fowls, placed in separate accounts or together, according to importance. It is usually desirable to keep the horses separate, as, unless breeding is carried on, depreciation must be allowed for and loss incurred.

3. Plant, Fixed and Movable.—Where much heavy fixed plant is in use, the two classes may be kept distinct, as differing allowances for depreciation have to be made.

4. Farm products on hand (ready for sale or use).

5. Farm products growing.—If the inventory is made at the slackest period of the year, these may not be very extensive, and may even be neglected. To prevent an over-estimate, any such crops should only be priced at the cost of labour, seed, and manure, the benefit of any profit being carried to the year in which the harvesting is done.
6. Furniture and domestic effects.

This must be supplemented by a statement showing the cash in hand or in bank, debts owing to or by the farmer, promissory notes, mortgages, &c.

Possibly the most difficult task is the assigning of a value to the farm and buildings, and the tendency would be to overestimate it. Due consideration must be given to the original cost, and to the subsequent improvements, whether made by the farmer in the ordinary course, or carried out by tradesmen for a definite amount. In the case of a tenancy, an estimate must be made of the present worth of any additions or improvements, based upon the fact that the value of such must be spread over the term of the lease and will be considered as of no value at the end.

A Balance-sheet.

This will constitute his balance-sheet, showing his assets, or what he owns, on the one side, and his liabilities, or what he owes, on the other side, and the difference between these two will be his capital—provided, of course, that the assets exceed the liabilities.

All such balance-sheets inevitably include approximations to value, and not actual values (which can only be ascertained when a sale is effected), and, therefore, the merit of any system of book-keeping must depend, first and foremost, on the nearness to accuracy of the various valuations.

SPECIMEN BALANCE-SHEET.

Dr. (*or Liabilities*).	£	s.	d.	*Cr.* (*or Assets*).	£	s.	d.
To Stores	25	0	0	By Land, Buildings, &c.	850	0	0
„ Interest unpaid ...	20	0	0	„ Stock	320	0	0
„ Loan from Bank ...	400	0	0	„ Plant	96	0	0
„ Capital	1,010	0	0	„ Crops	84	0	0
				„ Sundry Debtors ...	105	0	0
	£1,455	0	0		£1,455	0	0

It will be seen from this example that four out of the five divisions into which the assets are divided, must of necessity be valuations on the part of the owner, and if in any way inflated will, when realisation takes place, reduce the stated capital to its correct figure.

The next Essential—a Diary.

The inventory, especially if taken on January 1st, might well be copied on the opening pages of a diary. These are cheap enough, and the foolscap sizes, with two or three days to a page, and sufficient space at the end for a financial summary, are eminently suitable. (If preferred, a well-bound book, ruling columns for several years for the insertion of values, may be used. An example of this is given later.)

All the transactions should be recorded in the diary as they occur; and, in addition, it is wise to note the doings of every labourer (in a special book, if necessary), the date of service of the farm breeding stock, the plantings and harvestings, the rainfall, frosts, unusual winds, &c. Many an otherwise unaccountable variation in the yield of two similar crops sown at almost the same time may be understood by reference to some such record, and many of the innumerable problems which incessantly confront the agriculturist may by this means be solved.

At the end of each month a summary should be made of the receipts and expenditure, and in this some discrimination is needed. It is not enough to pay the storekeeper's bill of, say, 90s. Of this 55s. may be for groceries, 20s. for seed, 5s. for plough-lines, harness oil, &c., 7s. 6d. for a new ploughshare, and 2s. 6d. for an odd ball of binder twine. Similarly, the blacksmith's bill may include shoeing, to be charged to horses, repairs to ploughs, new tires, &c., to the implement account, and new gate-hinges to buildings and fences. In just the same way, the receipts must be classified, and credited to crops, cattle, sheep, pigs, fruit, &c.

From this summary of the month's transactions, the Journal (to be afterwards explained) may be made up. All receipts should be kept and numbered, all payments made by cheque as far as possible, and all account sales of produce, stock, &c., carefully preserved for future reference.

It may not be out of place to suggest here that a page of the diary might well be used for a few particulars regarding the fire and life policies (giving No., amount of premium, when due, and where the policy is kept), details of any mortgages on the farm, and rough details (if actual copies are not on hand) of any agreements with labourers, clearers, &c. Such information may be required at a moment's notice, and may be of paramount importance when the owner is, through sickness or other cause, absent at the time when payments are due.

These are good grounds for the opinion that an accurately made inventory and a regularly kept diary conduce as much to a thorough knowledge of one's affairs as a journal or a ledger.

The Principles of Double-entry Book-keeping.

Having thus laid down the broad outlines upon which any system of book-keeping must be carried into effect, it is now necessary to briefly describe "Double Entry" as the most suitable for the farmer. It may entail a few more figures, but the ease with which its correctness may be proved, and the balance-sheet compiled, make it the system least open to criticism.

It is based upon the general principle that every transaction, whatever its nature, concerns two accounts, or has two aspects—that of a receiver and that of a giver. If money is paid into the bank as the result of a sale of stock, the bank account *receives*, while the stock account *gives*. If 100 corn bags are bought at 6d. each, and these are used to market the crops, the crop account *receives*, and the bank (or cash) account *gives*.

If, then, this principle is carried out in its entirety, and the same figures (though in different accounts) appear on both sides of whatever books are kept, a failure of the totals to correspond would certainly indicate an error, which must at once be looked for.

The two books which are needed to supplement the diary, or whatever means are used to make a rough record of daily happenings and transactions, are the Journal and the Ledger. The former is written up in order of date, and the latter according to the account to which the entry belongs.

Simple Rules.

The following rules epitomise the fundamental principles of correct book-keeping:—

1. Debit the receiver, or that which is received; credit the giver, or that which is given.
2. Debit losses; credit gains.
3. Every debit must have a corresponding credit.
4. The sum of the debits must equal the sum of the credits.

If the first two rules are clearly grasped, the others may be neglected, as they are merely the logical outcome.

Custom has led to the placing of the debits on the left-hand side of the page and the credits on the right.

Classification of Accounts.

Some classification of the various accounts simplifies matters, and though two sections are occasionally advised, viz., real and personal, a more extended division into four classes has obvious merits. These classes are:—

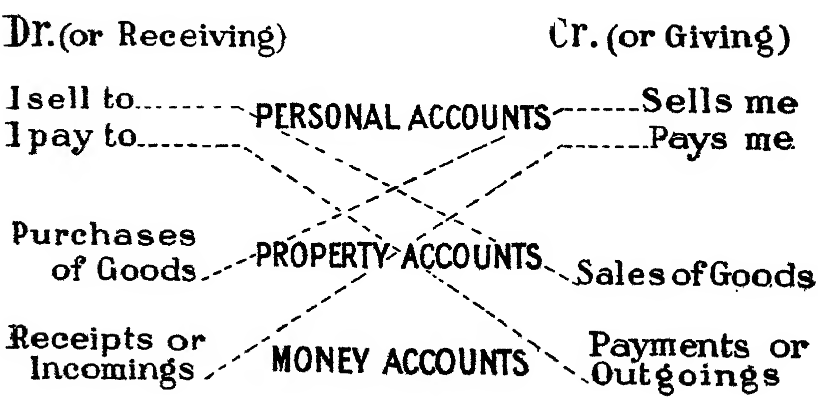
Personal, or accounts with persons.

Property, or dealings in goods, live stock, &c.

Money, or records of receipts and expenditure.

Convenience, or nominal, such as expenses, interest, discount, wages, &c.

The following diagram may serve to illustrate the method of journalising the first three divisions:—



The Journal.

The Journal is ruled with the following columns:—"Date," "Name of account debited," "Name of account credited," "Ledger folio (or page on which the corresponding entry is posted in the Ledger)," "Amount of cash (or value) debited," "Amount of cash (or value) credited."

The method of writing up the Journal may be thus illustrated:—

Diary entries:—Jan. 1, 1910—Bought 700 corn bags at 6d. each, from T. Brown. Jan. 17, 1910—Paid for bags by cheque.

Being for crops, they are charged to that account.

Date.	Dr. Cr.	Ledger Folio.	Dr.	Cr.
1910.			£ s. d.	£ s. d.
	Crops, Dr.	...	17 10 0	
1 Jan.	To T. Brown	...		17 10 0
	T. Brown, Dr.	...	17 10 0	
17 "	To Bank	...		17 10 0

In actual practice, as payment is made before the end of the month, the transaction can be treated as a cash one, and the entry would then be stated, as "Crops Dr. to Bank," without involving the use of Brown's name.

Additional value may be given to the Journal by briefly describing the transaction:—

	£ s. d.	£ s. d.
Crops, Dr.	17 10 0	
To T. Brown		17 10 0
700 corn bags at 6d.		

Where the journal is compiled from rough memoranda, and not from a regularly-kept diary, this is distinctly advantageous.

Reference has already been made (see page 419) to the necessity for analysing the various receipts and expenses, to ascertain the accounts to which the amounts should be charged. The storekeeper's bill, if paid as soon as due, could be journalised thus:—

	Dr. £ s. d.	Cr. £ s. d.
Household (groceries)	2 15 0	
Crops (seed and twine)	1 2 6	
Implement (shares, &c.), Dr.	0 12 6	
To Bank		4 10 0

An elementary example of a year's business dealings is here given to explain the foregoing principles. The transactions are really a summary of a diary, and thus no dates are mentioned.

J. Bull starts with a capital of £1,000, which is banked. He buys horses for £150, and stock for £400 cash, together with implements from the Sydney Plough Co., for £50 (not paid). He sells stock to James for £300 (not paid), crops for £100 cash, and butter for £10 cash. £120 is paid as wages, and

£80 as rent. Valuations at the end of the year are:—Stock, £300; crops, £60; plant, £40; and horses, £140. Interest charged on capital at 5 per cent. per annum.

Date.	Dr. Cr	Ledger Folio.	Dr £ s. d.	Cr. £ s. d
	Bank, Dr.	2	1,000 0 0	
	To Capital	1		1,000 0 0
	Horses, Dr.	3	150 0 0	
	To Bank	2		150 0 0
	Stock, Dr.	4	400 0 0	
	To Bank	2		400 0 0
	Plant, Dr.	5	50 0 0	
	To Sydney Plough Co. ...	9		50 0 0
	James, Dr.	8	300 0 0	
	To Stock	4		300 0 0
	Bank, Dr.	2	100 0 0	
	To Crops	6		100 0 0
	Bank, Dr.	2	10 0 0	
	To Dairy	7		10 0 0
	Wages, Dr.	10	120 0 0	
	To Bank	2		120 0 0
	Rent, Dr.	11	80 0 0	
	To Bank	2		80 0 0
	Interest, Dr.	12	50 0 0	
	To Capital	1		50 0 0
			£2,260 0 0	£2,260 0 0

Entries need not be made of the valuations.

(*To be continued.*)

Fat Necrosis.

A condition met with recently, as well as previously, and known pathologically as "fat necrosis" is important as having resemblance to old tuberculosis, or actinomycosis. Not infrequently in cattle peculiar whitish material occurs in parts naturally occupied by masses of fat—for example, round the kidney, in the omentum (apron), &c. These areas, which may be several square inches in extent, are distinguished from the surrounding fat by their whiter colour and granular structure. In hot cooked meat they contrast strongly against the now semi-transparent fat. Microscopical examinations show the condition to be due to the separation and deposit of crystals of fatty acid from the fat. The writer is aware of an instance in which such a condition nearly led to the condemnation of a carcase as tuberculous, and of another instance when his presence saved rejection of a wholesome joint of beef. For although the deposits taste like stearine candle they are not harmful. Once seen the condition is not difficult to recognise.

A specimen of oats, recently examined, recalled a familiar doggerel rhyme, in that there were found a rust (*Puccinia lolii*) parasitic upon the oat, and a fungus (*Darluca filum*) parasitic upon the rust.—*Bureau of Microbiology.*

Fruit Flies and other Insects attacking Cultivated and Wild Fruits in New South Wales.

W. B. GURNEY, Assistant Entomologist.

[In July, 1908, notice was given of experiments then about to be commenced under the direction of Mr. W. B. Gurney, Assistant Government Entomologist, at Narara, to demonstrate the necessity and utility of carrying out the Regulations under the Fruit Pests Act for the suppression of codlin moth and fruit fly and to study the life-history of these and other insects. Mr. Gurney has now furnished the following section of his report on these experiments, which will be of interest to all engaged in the fruit industry. The Queensland and Island Fruit Flies are found to be also natives of New South Wales, and to develop in our wild fruits; but what is of first importance to our growers is that the "Common" or "Mediterranean Fruit Fly" has *not* been found developing in our wild fruits. The finding of a Braconid wasp parasite in considerable numbers attacking the Queensland fruit fly maggots in thin-pulped wild fruits is interesting, and bears out the contention that, while parasites are common and more or less effective in wild fruits, they have little or no economic value in the case of cultivated fleshy fruits, with such pests as fruit fly maggots.]

Part I.

Acting under instructions from the Under Secretary for Agriculture, on the 7th May, 1908, the work was commenced of testing the value, within the orchard area from Gosford to Lisarow, including Narara, of carrying out the destruction of infected and fallen fruit and other requirements of the "Vine and Vegetation Diseases (Fruit Pests) Act, 1907." An important consideration was the study to be made of the life-histories and habits of the fruit flies and other insects, the sequence of crops attacked, and the part played by wild fruits in developing fruit flies and other insect pests. The work was to be carried on for two years, and I suggested this district for the following reasons:—It is isolated, which lessens the influence from adjacent districts; the district grows some of almost every fruit cultivated in New South Wales; it has its share of codlin moth and the three species of fruit flies, viz.:—The

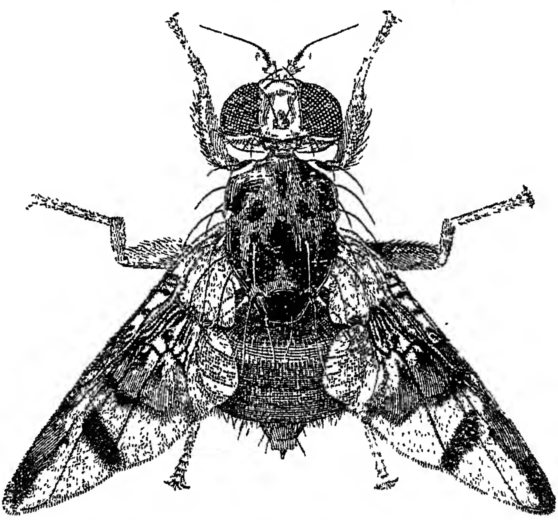


Fig. 1.—The "Common" or "Mediterranean Fruit Fly." [Enlarged.]
(From *Agricultural Gazette, N.S.W.*, June, 1899.)

Mediterranean, the Queensland, and the Island Fruit Fly; it is closely surrounded by dense scrub, with the wild fruits said to develop some of these pests; and finally, the district is small enough to allow of frequent visits being made by the inspector to the various orchards.

More than half the period has elapsed, and, though final results are not given in this part, a number of results of investigations carried out can be mentioned. A summary of these results is given first, to be followed by details from which conclusions are drawn, and this report forms the first of a series now being prepared.

I have to thank Mr. W. W. Froggatt, Government Entomologist, for suggestions during the operations; as well as Inspector L. Gallard, for his excellent work in carrying out investigations which I have indicated, both in the field and at the Insectarium, and in keeping detailed notes on insects developed, and a full record of the orchard inspections day by day. Also, I have to thank Inspector O. Brooks, of the adjacent district, who has furnished valuable information on fruit flies, parasites, and wild fruits in his locality, and Mr. F. R. Archbold, of Narara, whose orchard has always been kindly placed at our disposal for investigations and experiments, and in whose orchard our Insectarium is situated. I have to acknowledge with thanks various examples of wild fruit sent by Mr. Chas. Duffy, of Ourimbah, who also kindly indicated various places where wild fruit abounded.

SUMMARY.

Mediterranean Fruit Fly.

The Mediterranean Fruit Fly (*Ceratitis capitata*) or the "Common Fruit Fly" of our orchards (Fig. 1) has not been found developing in our wild fruits. This indicates that this fly is not spreading from the wild fruits into our orchards as was feared by many growers. Orchardists may, therefore, feel assured that by destroying maggot-infested fruit in their orchards they are checking the increase of the fly.

The exception to the orchard fruit-diet of this fly is an occasional record of a "prickly-pear," attacked when the fly has been especially numerous.

The summer season of 1907–8 was notable for the prevalence of this fly in our orchards. A cold, wet winter in 1908, and perhaps other causes, brought about a universal decrease of the pest throughout the orchards, and this, combined with destruction of infected fruit, resulted in so very slight an infestation during the following summer, 1908-9, that the fly was considered practically absent. During the next season, 1909–10, the summer just past, the fly again made its appearance much more freely, though still it has been only a slight infestation. In our Gosford-Narara district, however, we can record a decrease of fly to date over the previous season, the pest having only been noted in a few late peaches in March this year.

From an experimental point of view it is to be regretted that the common fruit fly was not more prevalent during the first season of our experiment, so that we might have demonstrated more definitely this season the value of destroying infected fruit as a check upon the increase of the pest. However,

on present results we can urge the effectiveness of frequent destruction of infected fruit; and carelessness of growers in this direction means increased fly infection during coming seasons. This is, perhaps, indicated by the increase this season in other districts over last season's infection.

Lillipilly berries do not develop fruit fly, so far as observed, though often asserted to do so, but are commonly infested by the small white grub of a brown weevil (*Storeus majusculus*), and also by the grub of a small moth.

Burying fly-infected fruit cannot be advocated. Pupæ buried 6, 8, and 12 inches below the surface of the soil hatched, and adult flies readily made their way to the surface in all cases.

Burning or boiling infected fruits is the most effective and satisfactory method of destruction. The maggots are not readily destroyed by liquids. After six hours in salt-water some maggots pupated and developed into flies. Infected fruit was submerged in salt-water (sea-water) for periods varying from 6 to 45 hours. In each case a large percentage of the maggots therein developed into adult flies. Some maggots immersed in methylated spirits for up to half an hour survived, and some survived dipping in kerosene. Though eventually the maggots would perish in the above fluids, yet these experiments indicate that no casual treatment (such as throwing infected fruit into a creek, wetting fruit with oils, &c.), can be considered a safe method for the destruction of maggot-infected fruit.

The following oils, placed in saucers in the orchards, were tried as traps for the adult flies:—Kerosene, citronella, linseed, salad, whale, neatsfoot, and fish. Kerosene oil in previous seasons where Mediterranean fly was prevalent has been found effective, and the non-success of any of these oils during these

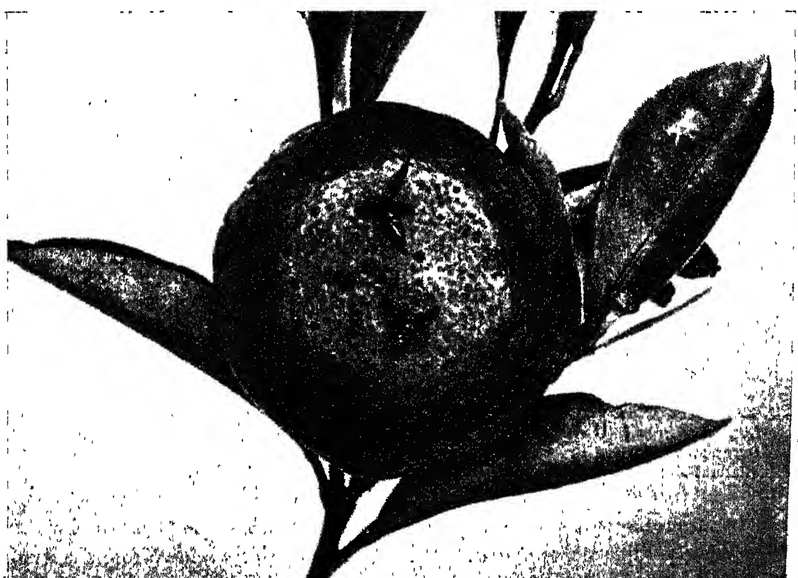


Fig. 2.—Queensland Fruit Flies (*Dacus Tryoni*) resting on an orange. [Natural size.]

Fig. 3.—"Black Apple" or "Native Plum," fruit of *Sideroxylon australe*, in which Queensland and Island Fruit Flies develop. [Natural size.]

seasons may have merely indicated the scarcity of the Mediterranean fly. Queensland fly, however, was not attracted from adjacent scrubs where it was developing; nor was Island fly attracted, though winged specimens were present in the orchards.

Queensland Fruit Fly
(*Dacus Tryoni*).

This fruit fly (see Plate 1, figs. D–G) is only an occasional pest of our orchards, and is apparently most prevalent in the North Coast districts.

We find it a native of New South Wales as well as of Queensland, ranging from Broken Bay to Queensland along our coastal districts, and we have developed it in great numbers each season from the wild fruits of our Gosford–Narara district and elsewhere. We find it infests the "Black Apple" or "Native Plum," the fruit of *Sideroxylon* (*Achras*) *australe*, from November to February; the berries of the "Cheesewood" tree (*Acronychia laevis*) during October and November; the berries of the "White Ash" (*Schizoneria ovata*) during February and March; and occasionally the "Wild Black Fig" (*Ficus stephanocarpa*), which fruits from March to May. This demonstrates that under natural conditions (away from orchards) at least four wild fruits sustain this native fruit fly over the period from late September to the following May.

This fly, however, generally prefers its natural food, the wild fruits, to orchard fruits; for we have from time to time developed the flies freely from wild fruits growing near (some within 100 yards of) the orchards, while the ripe oranges, comquats, peaches, &c., remained untouched in these immediately adjacent orchards. Within the district we have found actually thousands of these flies as maggots in the wild fruits from January to March, and numbers have been developed from them within our breeding cages,

while scarcely any infection of cultivated fruit has occurred throughout the district during our investigations. In the wild fruits, generally one, sometimes two or three, maggots may be found in each infected White Ash berry; in the wild "Black Apple" from two or three up to over a hundred Queensland flies may be developed from a single infected fruit.

A useful Fruit Fly Parasite.

An internal parasite of this Queensland Fruit Fly has been bred out at the Narara Insectarium on several occasions. This is, I think, the first record of a native parasite of a fruit fly in Australia. It is a small

Fig. 4.—White Ash berries from beneath a tree at Narara, 70 per cent. of which were infected with Queensland Fruit Fly maggots.

red-and-black wasp of the family Braconidæ, and will be described elsewhere. It is, however, figured in this report (see Plate 1, figs. A, B, C), and the female may be described as being $\frac{1}{7}$ inch (3·5 mm.) in length, with an ovipositor making a total length of $\frac{1}{3}$ of an inch; a wing expanse of $\frac{1}{3}$ of an inch; and long slender black antennæ. The head and thorax are bright orange-red in colour, the abdomen black, marked with white towards the base. The two pairs of transparent wings have a smoky appearance. Two specimens were developed early in 1908—the first, a male, by Inspector O. Brooks

Fig. 5.—Braconid Wasps (males and females). Parasites of Queensland Fruit Fly. [Natural size.]

at Erina, and the second a female, which I bred from fly-infected fruit from Grafton. Last season eight specimens were bred out at the Narara Insectarium, and this season some 275 males and females were developed; and we have definitely proved it to be a fruit fly parasite, not a parasite of moth-grubs which also infect wild fruits, by breeding specimens from isolated fly pupæ and abstracting them from the pupæ.

The female bears a long bristle-like ovipositor, with which the egg is laid. The tiny maggot, hatching from the egg, feeds inside the fruit-fly maggot, which, however, is not killed until after it has pupated. Then the internal parasite itself pupates, changes to the adult winged wasp, and escapes from its host by bursting open the fly pupal shell at the end from which the fly would normally have escaped.

Whether this Queensland Fruit Fly parasite could be of value when used against the common fruit fly will be the subject of further experiment.

Island Fruit Fly (*Trypeta muscæ*).

This fly we find is also a native of the coastal districts of New South Wales, and ranges from Bulli northward to Queensland. This species was described from specimens said to be from the New Hebrides, hence the name, but it is possible that the locality of origin was Queensland. We have bred them frequently, and in large numbers, from "Black Apple" (*Sideroxylon australe*) from various localities. Half-a dozen up to 130 of these flies have been developed from a single "Black Apple."

However, we find not only that this fly prefers native fruits to cultivated fruits, but also that it is not likely to be so serious a pest as was feared at first. When found in orchard fruit it rarely attacks sound fruit, but prefers to lay its eggs in previously damaged fruit—such as fruit already punctured by the other fruit fly species, or thorn-pricked, or cracked or rotting fruit, sometimes in codlin moth-infested apples, and quinces—and even on the surface of damaged fruit. Though the fly was commonly seen on the wing in the orchards, sound fruit was rarely if ever affected. In attacking unsound fruit it does not play the rôle of a serious pest, as the fruit is already unmarketable.

The egg, larvæ, and pupæ stages of the different flies, some of which are being figured for the first time, will appear in these reports.

Various other flies, and some species of moths attacking both cultivated and wild fruits, will be described and figured later.

Finally, when the time has elapsed, a full report and tables of fruit fly and codlin moth infection during the period of experiment will be given, and results indicated.

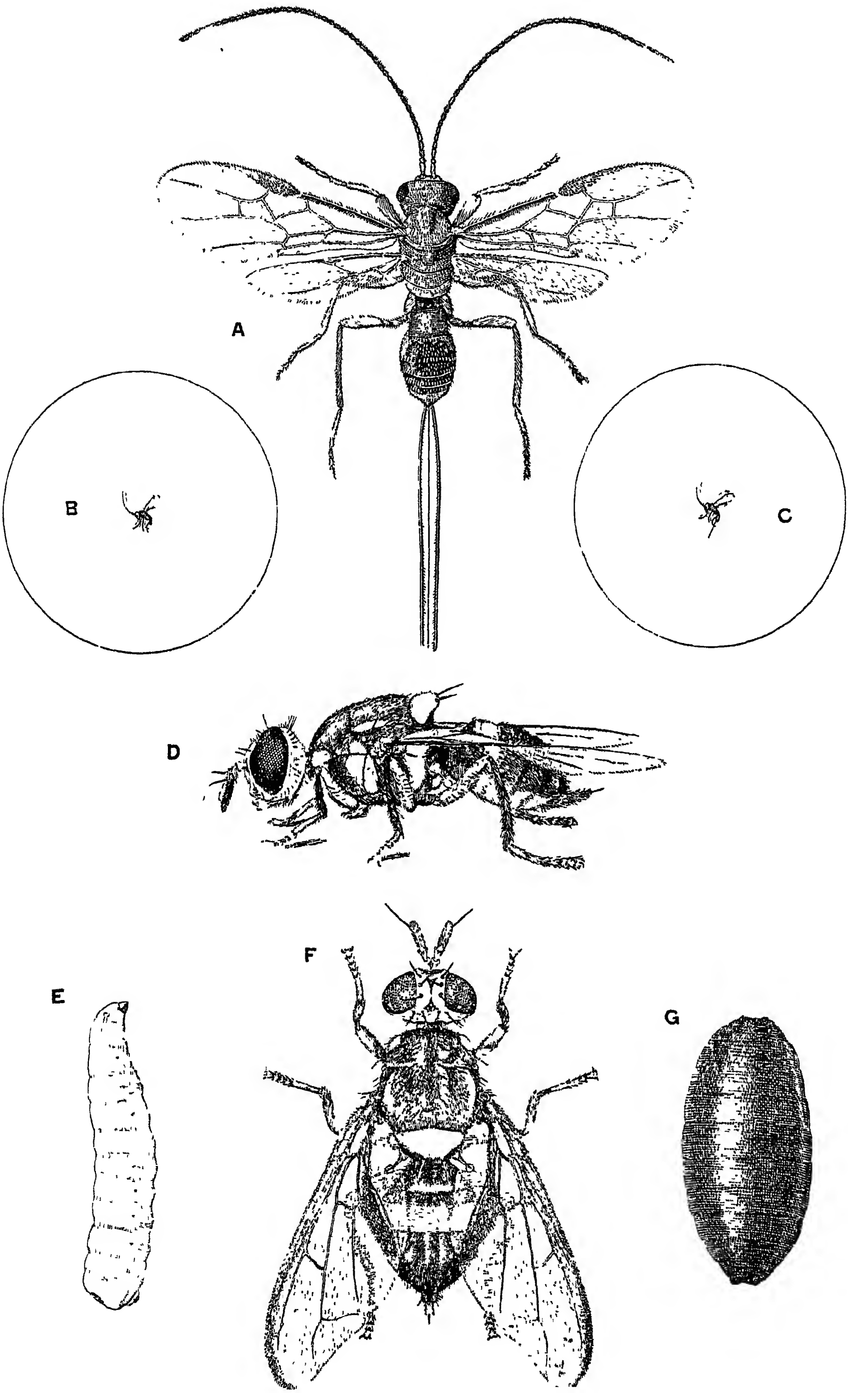


PLATE I.—QUEENSLAND FRUIT FLY AND PARASITE.

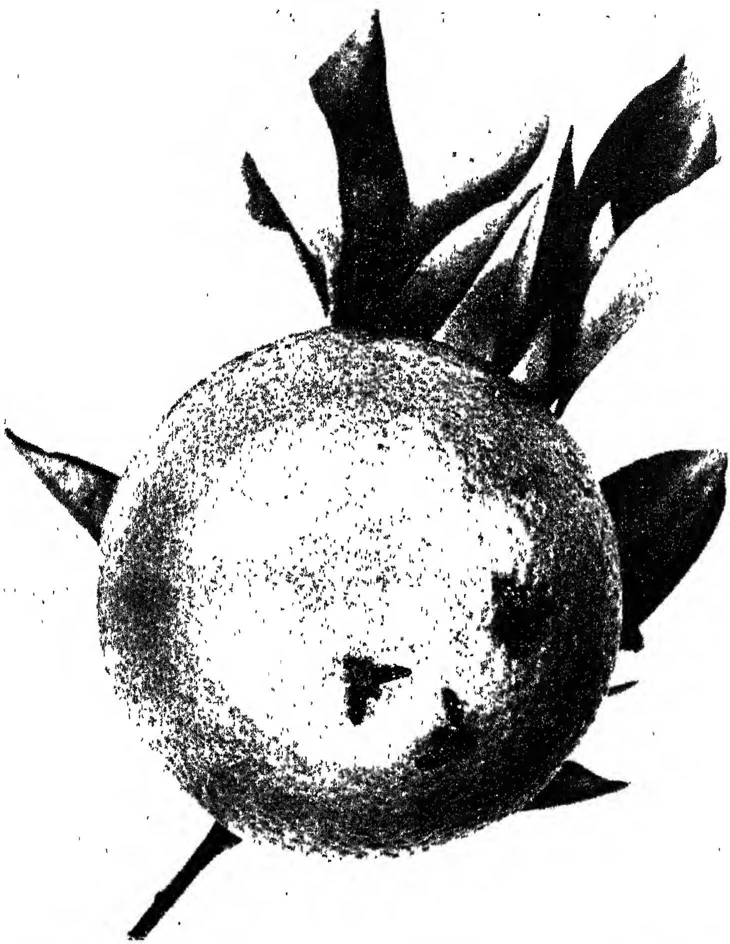


Fig. 6.—Island Fruit Flies (*Trypeta musæ*) in characteristic positions on an orange, showing one inserting eggs into a thornprick. [Natural size.]

EXPLANATION OF PLATE 1.

Queensland Fruit Fly and Parasite.

A. Red and black Braconid Wasp (female), a newly discovered parasite of Queensland Fruit Fly maggots. The three bristles of ovipositor separated. [Much enlarged.]
B and C. Natural size of the male and female wasp parasites.
D and F. Queensland Fruit Flies.
E. Maggot of same.
G. Pupa of same.

(D, E, F, and G, from *Agricultural Gazette, N.S.W.*, June, 1899.)

THE "COMMON," OR "MEDITERRANEAN FRUIT FLY"

(*Ceratitis capitata*).

In New South Wales this fly attacks :—

Oranges, mandarines, comquats, Seville oranges, persimmons, peaches, apricots, nectarines, and guavas.

Occasionally, common and Lisbon lemons, plums, apples, pears, quinces, citrons and figs.

Exceptionally, "osage orange" (*Maclura aurantiaca*), chillies, passion fruit, and "prickly pears" (*Opuntia spp.*)

The adult fly is two-winged, about the size of a house-fly, but with prettily marked wings and body. The male bears a pair of stalked spatulate processes on the front of the head, which are not present on the female.

The female bears a pointed ovipositor at the hind end of the body, which can be protruded to allow of penetrating the fruit, and the eggs are inserted to depths of $\frac{1}{8}$ to $\frac{1}{4}$ of an inch.

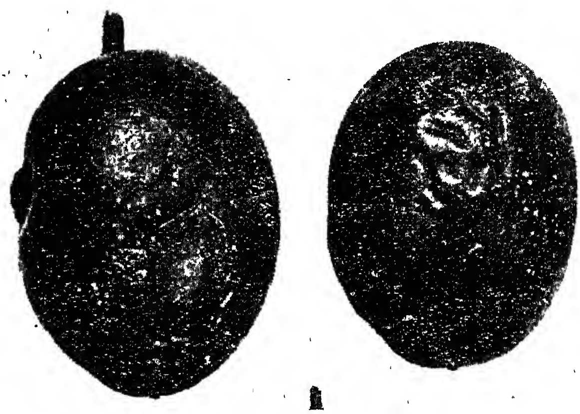


Fig. 7.—Passion Fruit stung by Fruit Fly, showing lump or blister caused by the puncture.

With regard to egg-laying, I made the following note in 1907, when the flies were plentiful even as late as May and June. "In June I saw as many as nine fruit flies (*C. capitata*) at the same time on one orange tree. One fly worked her ovipositor into the skin of an orange, and apparently laid eggs, the whole time occupied being 13 minutes. Similarly another spent only $1\frac{3}{4}$ minutes, a third between 2 and 3 minutes. One fly crawled away, but returned to and used the same puncture. Another checked herself suddenly, turned round and inserted her ovipositor into a puncture made previously. On crushing one ovipositing, eleven eggs were taken from the abdomen ; others may have been crushed or previously laid. The flies were continually halting and using their probosces, apparently lapping up oily secretions to be seen on the skin of the oranges."

The female puncture often causes the immediate tissue to decay and shrink away slightly from the eggs, and thus a small cavity is formed beneath the skin. In ripening oranges, a small circular area of brighter-coloured skin marks the puncture as if ripening had been hastened. In persimmons, a circular black spot of decayed tissue marks each puncture clearly. In peaches and nectarines, the actual punctures are less noticeable. In passion-fruit (punctured when young), a circular hard blister (see Fig. 7) is formed with a very decided cavity within, and this cavity becomes lined with a tough skin. The skin lining, or the hardness of the fruit's skin, probably prevents maggots penetrating to the interior of passion-fruit, for seldom do they succeed; and we have not bred any out in this district. However, Mr. T. W. Kirk reported in the 1905 Annual Report of the New Zealand Department of Agriculture having found this fly in one lot of passion-fruit said to be from Australia; and Fruit Inspector Smith reported in 1907–8 having found an occasional passion-fruit with a fruit-fly maggot inside.

The Egg.

The egg (see Plate 2, fig. B) is a minute white cylindrical body about ·86 mm. ($\frac{1}{29}$ inch) in length, slightly more pointed at one extremity, and the whole egg slightly curved. They are only to be seen by breaking open the punctured portion, where they are bunched together, and of a glistening white appearance; and generally a lens is needed to distinguish them. The eggs are inserted to depths up to $\frac{1}{4}$ of an inch.

The "Maggot" or "Grub" Stage.

When first hatched, the grub measures little more than the length of the egg, and is cylindrical and white. When full grown, it measures up to 8·5 mm. ($\frac{1}{3}$ inch) in length, and is then ready to crawl from the fruit, when it quickly buries itself in the soil, and changes to the pupal stage within a few hours.

The young maggots when just hatched are very active and comparatively hardy, and, if taken from the fruit, crawl perhaps some 6 inches away. When placed in 33 per cent. alcohol, they remained active for five minutes; and in 90 per cent. alcohol, for about a minute. Later, the maggots are even more hardy, and resist wetting with kerosene; from such wetted maggots, and some immersed in methylated spirits for half an hour, perfect flies were developed. A maggot put in sea-water in a test tube pupated at the surface against the glass. Badly-infested oranges were submerged in sea-water for 6, 8, 24, and 45 hours respectively, and in all cases a large percentage of the maggots in this fruit survived, pupated, and hatched into apparently healthy adult flies. As was to be expected, the longer the fruit had been submerged, the fewer maggots survived. Though the maggots in submerged fruit would perish if left permanently in even fresh water, these experiments hint at the danger of considering that merely wetting fruit with oils, throwing infected fruit into a creek, or temporarily immersing it in water, will answer as a certain method of destroying maggots in fruit. Burning or boiling is the simplest and most effective method known.

Soon after hatching from the eggs, a slight "give" in the fruit is noticeable where the maggots are at work, and a bead of juice can generally be squeezed out, indicating the presence of infection.

The maggot has the pointed head and the blunt posterior end so characteristic of many fly-grubs. (See Queensland Fly Maggot, fig. E, Plate 1.) The narrow head end bears a pair of black curved jaws, capable of being drawn into and protruded from the head, which are used for tearing the fruit tissue. They frequently jump or skip, in the manner so often noticed, when taken from the fruit. The maggot doubles the body, hooks the jaws to certain small lobes about the anus, sets up a strong muscular strain, and suddenly releases the jaws from their hold, the effect of which is to jerk the body some 6 or 8 inches away. These movements are repeated until the maggot finds itself in a more congenial position as to food or moisture, and out of the light, or where it can burrow into the soil to pupate.

On each side behind the head is a cluster of minute spiracles or breathing pores arranged in a row. A pair of tubes or trachea running through the body connect these anterior spiracles with two sets of spiracles at the posterior end, which are arranged in two sets of three openings. Each of these posterior openings is guarded by a row of fine, closely-arranged hairs, which are probably used as screens against entrance of juice and dirt into the trachea (breathing tubes).

Maggots Pupating.

The full-grown maggots crawl from the fallen fruit, and work their way into the ground to depths varying up to 3 inches. Twenty maggots (full-grown) put on loose garden soil, pupated at the following depths:—Six at about 1 inch, two at $1\frac{1}{3}$ inches, five at $1\frac{1}{2}$ inches, five at 2 inches, one at $2\frac{1}{2}$ inches, one at 3 inches. Within 2 inches is the usual depth. In Seville oranges, which hang long after being infected, the maggots are sometimes found to have left after eating out most of the fruit, and have presumably dropped to the ground. In the case of infected apples, pears, and quinces, the maggots do not always leave the fruit to go into the ground, but may remain and pupate in the rotting fruit itself.

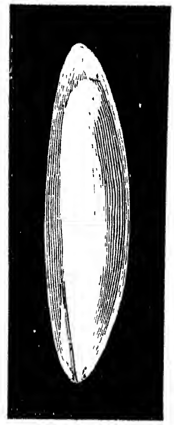
Packing Infected Fruit.

After the maggots have hatched in the puncture, and been feeding for a few days, the "give" or decay at the affected part is readily detected by hand, and packers can easily sort out such fruit; it is the punctured or "stung" fruits, with unhatched eggs in them, that require to be watched for and rejected, to prevent a consignment developing maggots later on.

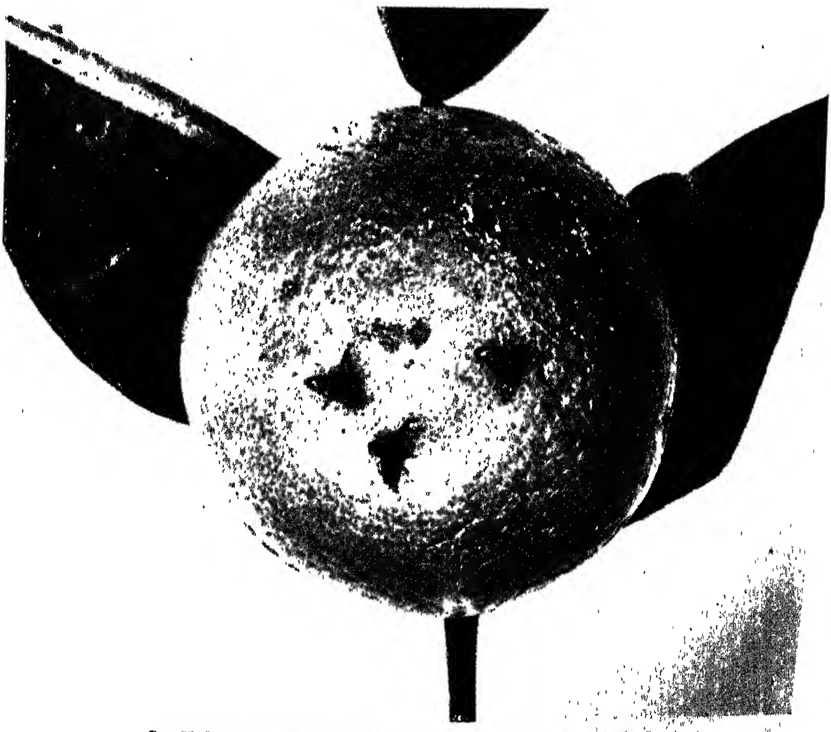
The Pupa.

This is the quiescent stage, corresponding to the chrysalis stage of the butterfly. The full-grown maggot, having burrowed into the soil, shrinks in length, and its skin hardens and forms the oval pupa shell (see fig. G, Plate 1) which in colour varies from dirty white to dark brown, and measures 45 mm. ($\frac{1}{6}$ inch) in length. The size may vary slightly, probably according to the food available for the maggot.

A.—Mediterranean Fruit Fly (*Ceratitis capitata*) Male. [Enlarged.]
(From *Agricultural Gazette*, N.S.W., June, 1899.)



B. Egg of Mediterranean Fruit Fly.
[Much enlarged.]
Natural size
$\frac{1}{30}$ inch (·86 mm.).



C.—Mediterranean Fruit Flies (*Ceratitis capitata*). [Natural size.]

PLATE II.—COMMON OR MEDITERRANEAN FRUIT FLY.

The time occupied in the pupal stage in summer is about 12 to 14 days. During January and February, eighteen observations gave the following record for the pupal stage :—Two occupied 12 days; three, 13 days; seven, 14 days; one, 15 days; four, 16 days; one, 17 days. In other cases, 11, 12, 13, and 19 days were recorded.

The pupa develops into the adult-winged fly, which bursts through one end of the pupal shell and forces its way up through the soil to the surface, and soon flies off to lay eggs in the fruit.

Adult Fly.

Adult flies (see Plate 2) we find live in confinement in cages, from several days up to three weeks. In the orchards, with natural food and conditions, life is probably longer. In summer, they may be seen flying about the trees and puncturing fruit; and even in the colder months may occasionally be seen, though the majority are then in the pupal stage in the soil. The fly runs across the fruit and leaves in a series of short spurts, and the wings are held in a characteristic manner at an angle with the body of about 45 degrees. Several other flies, attracted by exudations from the trees, and from scale and aphis, are often mistaken for the true fruit flies. In common with most insects, the adults are much less active on cold than on warm days.

(*To be continued*)

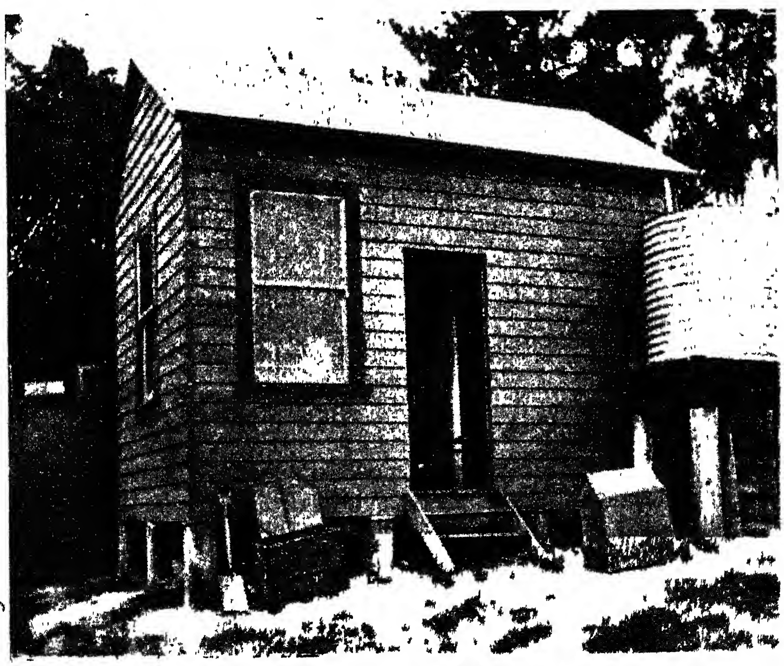


Fig. 8.—Narara Insectarium, where insects attacking orchard and wild fruits are under observation.

C

Injurious Substances in the Soil.

Bare Patches, etc.

F. B. GUTHRIE.

It frequently happens that large or small areas of land are found to be unproductive or of poor quality, although from their origin, and the nature of the surrounding country, one would expect them to possess a high degree of fertility. Of such nature are the bare patches often met with in otherwise fertile areas.

Such bare patches may occur in areas of a few feet in diameter, or may be of very considerable extent. The causes of this infertility are various, and it is by no means easy in all cases to determine to what their unproductiveness is due.

The following are some of the instances most commonly met with.

Shallowness of Surface Soil.

It may happen that the rock from which the soil is derived has weathered unequally in different parts, and that undecomposed rock is found quite close to the surface, thus forming a very shallow surface soil on which nothing but the most shallow-rooted crops will grow, and resting on a hard stratum through which water will not penetrate. Crops or trees growing on such soil may do fairly well until the roots reach the impervious layer, when they begin to wilt.

The same result is produced when a hard pan or layer of impervious material is formed below the surface This hard pan may be formed mechanically by the plough, either by ploughing stiff clay when it is wet, or by ploughing repeatedly at the same depth. It may also be formed naturally by the cementing together of the particles of sand and gravel of the subsoil by humates and silicates, particularly humates and silicates of iron and lime, and is especially likely to occur in ironstone country. The remedy is to break up the hard layer by deeper ploughing, and to apply slaked lime.

Scalded Plains.

Where conditions are such that a shallow and dry surface soil, or a soil deficient in vegetable matter, is exposed to the action of wind, large areas are frequently denuded. In such cases the top soil is carried away and a hard surface exposed, destitute of vegetable matter, and which is useless for the production of crops, or even of grass, until it has been thoroughly worked and brought under cultivation for some time. These patches form the well-known scalded or scoured plains of greater or less extent occurring in the arid and semi-arid districts, and particularly in thinly timbered country.

The same thing happens in such parts as have been heavily trampled by stock on stock routes and camping-places. Such lands require only to be well ploughed and exposed to the influence of rain and sun to render them again productive.

Sourness.

This is one of the most common causes of infertility in soils. It is brought about either by the absolute exclusion of air, as in water-logged soils or soils in which the surface has been impacted; or it may also be the result of an excessive amount of organic matter, as in peaty soils. In both cases the result is the formation of organic acids (humic acid, &c.), which, in the absence or deficiency of basic substances, such as lime, to neutralise them, act as plant poisons. They not only affect the growth of the plant, but have a solvent action upon the soil constituents, which are liable to be dissolved out and pass into the subsoil. Soils which are red or chocolate in colour from the presence of oxide of iron, if allowed to become sour, are very frequently bleached in colour. They also exercise a reducing action upon the higher oxides, such as ferric oxide, reducing it to the state of ferrous oxide. It is commonly stated that this latter substance is itself a plant poison, but since this compound would not be present in soils in good tilth, but would be converted into the higher (ferric) oxide, it is probable that the ill effects noted when ferrous oxide is present are in reality due to sourness, and that the presence of ferrous oxide is only one of the results of this condition.

The remedies for sourness are thorough cultivation and turning of the soil and exposing it to the air. In cases where it is the result of accumulation of water (in swampy soils) it will be necessary to have recourse to drainage. The addition of lime to neutralise the acids formed is in all cases beneficial; and by a proper system of drainage, together with thorough cultivation and the addition of lime, it should be possible to reclaim the most sour land. A sour condition of land is usually quite readily recognisable by the experienced farmer from its appearance, the peculiar odour when moist, &c.

As this condition is due to acidity, sour soils have always a strong acid reaction towards litmus; but as this reaction is influenced by other factors, it is not a reliable indication except in experienced hands. It must also be remembered that cultivated soils nearly always possess an acid reaction.

Protoxide of Iron and Pyrites.

The presence of these compounds in the soil is generally an accompaniment of a sour condition of the soil, and is due to the same cause—want of aeration. It is doubtful whether they are themselves active plant poisons, but their presence is always associated with an infertile condition.

The presence of ferrous oxide is indicated by a bluish or greenish coloration in the clay. This colour changes to red or reddish brown when the soil is aerated.

Pyrites and marcasite (sulphide of iron) are commonly occurring minerals, and their presence unchanged is also a sign of deficient aeration.

It is also stated that ferrous sulphate, the substance into which the sulphide is at first converted on oxidation, is itself a plant poison if present in excessive quantities, so that such soils will require very thorough aeration in order to convert the ferrous sulphate into the fully oxidised ferric compound.

At the same time it must be remembered that ferrous sulphate is recommended by many writers as a manure. A very effective fertiliser was prepared locally by mixing boiling-down soup with ferrous sulphate. It is probable that the injurious effects noticed when the compounds under discussion are present are due less to the substances themselves than to the conditions under which they are produced.

The treatment of soil in which these substances are present is the same as in the case of sour soils—cultivation, liming, and draining.

Alkalinity.

The reverse condition to that of sourness, and one equally injurious to plant life, is the presence of alkali in the soil. As far as New South Wales is concerned this alkalinity is due to the presence of carbonate of soda, and is almost exclusively associated with the use of bore water; naturally occurring alkali soils such as are found in other parts of the world are practically non-existent.

The continued use of bore water, especially when used to flood the land, and on land which is level and has no adequate natural or artificial system of drainage, results in the accumulation on the surface soil, as the water evaporates, of a white incrustation of carbonate of soda. This substance (alkali) acts injuriously in several ways. It corrodes the stem or crown of the plant or tree with which it comes in contact at the surface; it dissolves out the humus or vegetable matter of the soil, and it combines with the clay, forming a substance which is extremely slimy and sticky when wet, and which dries to a hard mass which it is almost impossible to break up with any agricultural implement. On drying, the surface contracts and opens out in cracks, thus damaging the roots of the crops.

If it is necessary to use this class of water for irrigation, the following precautions must be taken:—

The land must be efficiently drained if there is no natural run-off for the water; the water must be run on in channels and cross-furrows so that it penetrates the soil laterally; it must be used in moderation, and not allowed to lie on the surface; the surface soil should be continually cultivated with the harrow, and, if possible, kept well mulched with vegetable matter.

Of the substances recommended to neutralise the effect of alkali, gypsum (sulphate of lime), in the form of powder, was first suggested by Professor Hilgard for the alkali lands in the United States, and has been found successful. Its use has not been adopted locally to any extent, but there can be no doubt that it would be effective. It can be applied either directly to the land itself, or placed in the channels or flumes so that the water has to pass over it.

The use of nitric acid has also been suggested; but, unfortunately, the results of the experiments so far carried out locally have not been very definite. The application of an acid naturally suggests itself as the most obvious means of neutralising an alkaline substance, and nitric acid has the additional advantage that it converts the injurious carbonate of soda into a

valuable fertiliser—nitrate of soda. Recent experiments reported by the Queensland Department of Agriculture indicate that it can be applied with benefit to the bore water in proportions which will depend upon the amount of alkali in the water.

Common Salt (Sodium chloride).

Except in the case of bore water, where its presence no doubt increases the injury done by the alkali, but where its power for evil is insignificant in comparison with that of carbonate of soda, common salt is hardly ever met with in our soils, other than those close to the sea or salt-water creeks, and liable to flooding. Crops vary considerably in regard to their power of tolerating the presence of common salt. Some plants, such as beetroot and asparagus, benefit from its presence; it is also said to be a good manure for mangels and cabbages; and such plants as saltbushes, &c., contain considerable quantities in their tissues. Most farm crops will stand as much as 0·2 per cent. salt in the soil, but if the amount exceeds this quantity, crops are likely to be affected.

The action of salt is injurious in several ways. It affects the production of nitrates and the process of nitrification, and also affects the texture of the soil. The addition of salt, in the first instance, flocculates the clay particles, and makes the soil temporarily more friable; but it has a very damaging after effect, due probably to its combining chemically, with exchange of base, with the silicates, particularly silicate of lime, and forming colloidal silicates, thus rendering the clay slimy.

Manganese.

Although salts of manganese, in small quantities, are found to be beneficial (indeed some chemists go so far as to say necessary) to the growth of crops, they are undoubtedly injurious in larger quantities. Several instances have come under our notice in which small, bare patches occur in a field otherwise fertile; and examinations of these patches and of the surrounding good soil have shown them to be similar in all respects, except that the bare patches contain manganese, whereas the good soil either contains none, or proportionately much smaller quantities.*

The action of manganese is peculiar, and extremely interesting. It would appear that certain compounds of manganese are more toxic than others, and that the higher oxides of the metal are more toxic than the lower, so that the process of aeration, usually of benefit in increasing the soil's fertility, has in this case a distinctly prejudicial action. The result is that it may happen that a soil may yield good results for a year or two, and suddenly develop toxic properties, due to the conversion of the more innocuous forms of manganese into higher oxides of greater toxicity. Another point of some interest is that, when the quantity of manganese present is small in amount, it frequently happens that crops suffer during the winter months, and, provided the quantity of manganese present is not excessive, recover themselves with the advent of the warm weather, and when their growth is more vigorous.

* See article on this subject in the *Agricultural Gazette* for March, 1910.

Soils containing excessive quantities of manganese are generally dark in colour, and frequently it is possible to distinguish small particles of manganiferous compounds, black in colour and very soft.

Generally speaking, manganese poisoning may be suspected when the affected patches are darker in colour than the normal soil, when the bad effects do not appear until the land has been under crop for a year or two, and when the crop suffers in the winter and recovers itself during the summer. It not infrequently happens that these bare patches change their position from year to year; that is to say, an area which was bare one season will resume its normal condition in the next, while other patches in the same paddock will become infertile. Such a condition of affairs will lead one to suspect the presence of manganese.

With regard to remedies, it has been found that the addition of superphosphates has a decidedly beneficial influence on such soils, probably due to the formation of manganese phosphate—a compound of lower toxic action than the oxide. The data so far obtainable are insufficient to justify this being put forward as an infallible remedy, but it has been found to be successful in cases where it has been tried, and is worth further trial.

Magnesia.

Although lime is one of the most important elements of soil fertility, magnesia, which is a very similar compound, and which is frequently found associated with lime, is by no means desirable in any considerable quantity. Although limestone rocks almost invariably produce the most fertile soils, those formed from dolomite (magnesian limestone), which is carbonate of magnesia, are of poor quality, and even the presence of any quantity of magnesia in the limestone renders the soil a poor one.

The general result of experimental work in the field and in pots tends to show that when the magnesia in a soil exceeds the lime the soil is an unproductive one. Loew, who has particularly studied this matter, finds that a certain ratio must be preserved between the lime and the magnesia in the soil. This ratio appears to vary with different crops; some crops do best when the amounts of these compounds are equal, whilst others require about two or three parts of lime to one of magnesia.

The remedy most likely to be effective in the case of soils whose fertility is due to excess of magnesia is the addition of lime in order to restore the balance, and such soils come under the heading of those which are deficient in lime, although actually the amount of lime salts present might be sufficient provided magnesia was absent.

Toxic Substances Secreted by the Plant.

It is well known that when certain crops are grown continuously on the same ground without fallowing or rotation, the land becomes unsuited for that particular crop. The cause usually assigned to this phenomenon, namely, that the continued growth of the crop in question removes certain elements of plant-food necessary to that crop, requires some modification in view of recent investigations.

The United States Bureau of Soils has advanced the suggestion that the plant during its growth secretes toxic material which is injurious to the succeeding similar crop, though not to crops of a different nature, and a good deal of work has been done in trying to isolate and identify these toxic substances. A corollary of this theory is that the beneficial action of fertilisers is due less to their actual value as plant-food than to the fact that they neutralise or otherwise alter these poisonous substances.

Another theory is that these plant toxins are formed not by the direct secretion of the growing plant, but by the action of bacteria upon the residues left in the soil by the crop. Such a theory would afford an explanation of such phenomena as clover sickness, &c., where it is found that bad results follow the continuous growth of the same crop on the same land, although the soil itself may show no appreciable loss of plant-food.

It must, however, be stated that these theories have not yet advanced much beyond the speculative stage; and that, although a considerable amount of work has been done, and several definite organic substances have been isolated, the toxicity of these substances in the field has not yet been established conclusively.

Whatever may be the real cause of the trouble, whether it is due to soil exhaustion or to the production of toxins, either by the growing plant or by bacterial action on crop residues, or to a combination of these causes, the remedy indicated will in every case be the same, namely, crop rotation or fallowing.

Excessive Concentration of the Soil-water.

Damage may also be done to the growing plant by otherwise harmless or even beneficial ingredients, when the solution in which they are presented to the plant is too concentrated. During dry spells, for example, the soil moisture will contain a relatively larger amount of soluble saline matter than under normal conditions; and it may quite easily happen that a soil on drying out during a dry spell may lose moisture to such an extent that the remaining water may contain an excessive quantity of salts in solution. If the quantity of matter dissolved in the moisture in the soil is in excess of that present in the cell of the plant-roots, the result is that the water will pass out of the cell into the stronger solution outside, with the result that the contents of the cell will shrink and the plant itself wilt.

The ill effects of want of water during a protracted dry spell are thus accentuated by the danger of an over-concentration of mineral matter in the remaining soil moisture. A rich soil, therefore, one well supplied with soluble plant-food, would be expected to show the ill effects of drought even more than a poor one.

This would also account for the fact that heavy manuring with artificial fertilisers is generally found to be rather harmful than beneficial in dry seasons, and that under such conditions light dressings are superior to heavy ones.

Calcium Chloride.

This substance is stated by some authorities to be harmful to the growth of crops, though I am not aware of any exact experiments being recorded which prove its toxicity in the field. We know that chlorides of other metals are frequently injurious. The case of sodium chloride (common salt) has been dealt with above, and potassium chloride is found to be much inferior to potassium sulphate as a fertiliser for certain crops (such as potatoes and tobacco); and it is quite likely that calcium chloride is an undesirable form in which to apply salts of lime.

In certain bare patches from Coolabah Farm examined by Mr. Cohen, and reported upon by him in the February number of the *Agricultural Gazette*, he found not only a condition of considerable concentration of plant-food in the soil moisture, which we have already seen is injurious, but only a small proportion of lime and an absence of carbonic acid; and from the fact that the soil from the bad patches was deliquescent, and contained a larger proportion both of lime and chlorine than the good soil, Mr. Cohen suggests the presence of calcium chloride.

In such cases, also, the addition of lime is the remedy which suggests itself, so that the crop can be supplied with lime in another form than that of calcium chloride Here, again, it must be borne in mind that the toxicity of calcium chloride has not been proved by exact experiment.

Alum.

A substance which is frequently accused of causing infertility in soils is alum. Alum is a double sulphate of alumina and potash, and it is not quite obvious why it should have such a bad name. In water cultures of spirogyra it has been recently found by M. Fluri (Bied. Centr. 1909, 38, p. 670) that proportions of aluminium salts as low as ·003 per cent. deprive the cells of starch. As a matter of fact, of all the soils examined here in which alum is stated to have been the cause of the trouble, none have contained alum; and the infertility has been due either to sourness (in the majority of cases) or to the presence of common salt.

Samples of incrustation or efflorescence occurring on such soils, and stated to be alum, turn out on examination to be salt or alkali, and the trouble is in all cases due to inefficient drainage, and disappears when the land is properly drained.

Absence of Elements Essential to Fertility.

In addition to the presence of the actively injurious substances enumerated above, soil infertility may be caused by the absence or deficiency of certain essential soil ingredients.

Want of lime, for instance, as we have seen, may induce sourness and a disturbance in the ratio between lime and magnesia. Its absence also affects the growth of many crops for which it is an essential plant-food, particularly leguminous crops, lucerne, clovers, &c. Its presence or absence modifies the texture of the soil, clayey soils in which lime is deficient being generally much harder to work when wet and less friable on drying than those which are

sufficiently supplied with it. Soils which are deficient in lime are less favourable media for the development of micro-organisms, particularly of the nitrifying organisms.

Deficiency in humus is a common cause of infertility. A soil deficient or wanting in humus is less able to withstand droughty condition, lacks cohesion, and is easily blown or washed away, and is unfavourable to the growth of micro-organisms.

The remedy is to apply vegetable matter which, by its decay, will provide the necessary humus. This can be done by green manuring, by ploughing under stubble, by addition of farmyard or compost manure, &c. The subject is dealt with fully in the *Farmers' Guide.*

Absence of bacteria, particularly of the nitrifying organisms, is prejudicial to the satisfactory production of crops. The cause is generally one or other of those discussed above, either want of aeration, lack of lime or vegetable matter, sourness, bad tillage or drainage, &c., and when such soils are restored to good condition the development of the nitrifying organisms will proceed normally.

Want of plant-food is, of course, a common cause of infertility, especially in the case of land which has been exhausted by repeated croppings without manuring or rotation. Proper manuring, having due consideration to the requirements both of the soil and of the crop, is the remedy, provided that the land is in good condition ; but the important fact must not be lost sight of that the mere addition of plant-food is not sufficient unless the soil is in such mechanical condition that it can make good use of the manure applied.

Manuring alone is not likely to be of any benefit on land that is badly drained, sour, or in bad tilth.

Presence of Organisms which destroy the Nitrogen-forming Bacteria.

In connection with one of the causes of sterility noted above, namely, the absence or deficiency of bacteria, the results of an investigation of the greatest interest and importance has recently been published by Messrs. Russell and Hutchinson from the Rothamsted Laboratory. These investigators find that probably in all soils the development of these bacteria is kept in check by the presence in the soil of certain larger unicellular organisms (Protozoa) which feed on the bacteria concerned in the formation of soluble nitrogen compounds.

If the soil is partially sterilized by heating for a short time to the temperature of boiling-water, or by subjecting it to the action of vapours such as chloroform, bisulphide of carbon, toluene, &c., such vapours being subsequently removed by spreading the soil out in a thin layer and allowing the vapour to evaporate, the effect is to destroy the protozoa and probably most of the bacteria as well, but not the spores of the ammonia-producing bacteria. These spores subsequently develop, and in the absence of the hostile protozoa, their development proceeds with increased activity, the result being a considerable increase in the soluble nitrogenous plant-food and a more vigorous crop growth.

These experiments have so far been carried out in the laboratory. If means are discovered of partially sterilizing the soil in the field a most valuable method of increasing the fertility of the soil will be placed at the disposal of farmer.

A Dangerous Weed.

"CALTROP" (*Tribulus terrestris*).

PASTORALISTS and farmers should be warned to keep a sharp lookout for the invasion of their paddocks by a very bad weed, the scientific name of which is *Tribulus terrestris*, which was briefly noted in this *Gazette*, Vol. VI, p. 671. It is known locally as Caltrop, on account of the resemblance of its seed-case to the spiked iron ball which was used in ancient times for throwing on the ground with the express object of maiming the enemy's cavalry. This implement had four spikes, three of which rested on the ground while the fourth perforated the frog of the horse's hoof.

This vegetable Caltrop is very much more insidious and dangerous, for its seed case has five spikes, and two of them therefore are always erect, ready to penetrate the foot of sheep, dog, cow, or horse, and to perforate the tyres of bicycles.

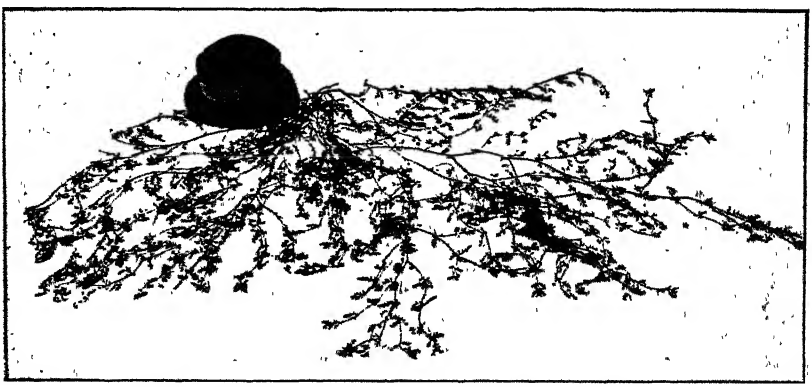


Fig. 1.—"Caltrop" (*Tribulus terrestris*) showing habit of growth.

It belongs to the natural order *Zygophylleæ*, and is a native of this State. It has already been reported as doing considerable damage at Narrandera, Coonamble, Wellington, and Bathurst. It is a creeper, running closely along the ground, as much as 8 feet in several directions from the main stem, bearing small yellow flowers about one-third of an inch in diameter, with five petals. It has a hard fruit, divided into five sections, each of which has a hard and sharp spine able to puncture the tyre of a bicycle.

At Bathurst, the show ground was badly invaded by this pest, which had probably been brought there by some of the exhibits from Western districts, and at last it was found necessary to skim the whole of the trotting

course and burn the soil to destroy the vines and fruit. In spite of this labour and great expense—not less than £50—many odd plants are being found in different parts of the ground at the present time, and extra men have to be engaged to dig out each individual plant and burn it.

It dies away in winter, but leaves enormous quantities of seed on the ground, each of the five sections of which will develop into a plant. It has such a keen idea of its own importance in the vegetable world and the necessity for its reproduction, that it will produce seeds on plants less than 3 inches in diameter, but generally the plants extend some feet in several directions.

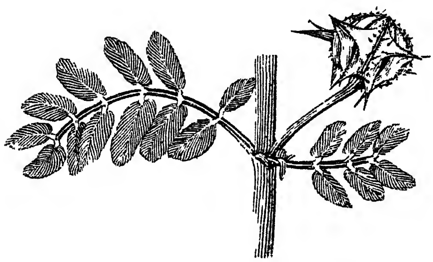


Fig. 2.—Section of stem showing leaves and seed-case. [Natural size.]

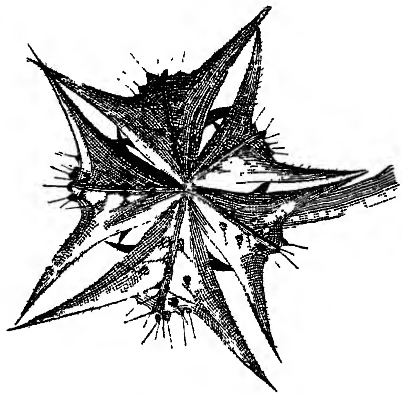


Fig. 3.—Front view of seed-case. [Enlarged.]

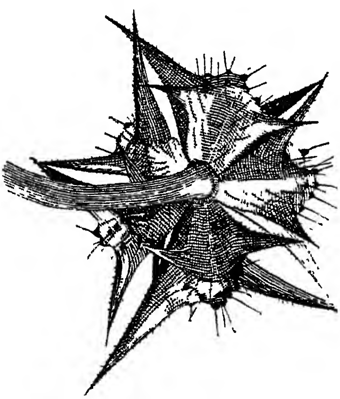


Fig. 4.—Back view of seed-case. [Enlarged.[

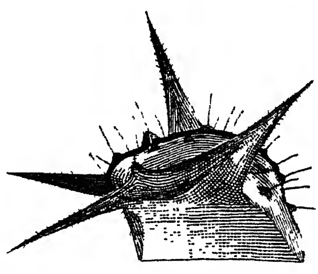


Fig. 5.—One of the five sections of seed-case. [Enlarged.]

It can be readily identified from the accompanying illustrations, and every landowner is warned to take immediate steps to exterminate any plant or plants that may be introduced into the district or on to his own place. Committees of Agricultural Societies are particularly warned to keep an eye on it, as it may be introduced by animals brought for exhibition purposes from districts in which the pest exists. It can lame all classes of animals, and is especially severe on horses, wounding the frog of the foot, where it causes intense irritation and suppuration. For a simple and expressive English name "Diabolic Caltrop" may be suggested.—H. C. L. Anderson.

ARTESIAN IRRIGATION.

AN ANTIDOTE FOR ALKALINE WATERS.

UNDER this heading an article by Mr. R. S. Symmonds appeared in the *Agricultural Gazette* for August, 1908, and the paper was subsequently reprinted as "Farmers' Bulletin No. 12."

Mr. Symmonds gave results of some experiments in pots with nitric acid as an antidote for the carbonate of soda occurring in artesian water, the effect of the acid being to neutralise the alkali and convert it into nitrate of soda—a valuable soluble fertiliser. Mr. Symmonds subsequently experimented with this method in the field in the Coonamble district, and a report on the subject appeared in the *Gazette* for March, 1910.

In the original paper the author drew attention to the possibility of producing nitric acid by the electrical process from the atmosphere, using the pressure of the bores itself as an economical source of power; and he quoted figures from "Irrigation and Land Drainage," by Mr. Gibbons Cox, C.E., to show the mechanical value of the pressures of certain bores.

Since the publication of the Bulletin, the Department of Agriculture has been in communication with the Department of Public Works, and the latter Department now intimates that Mr. Cox's calculations were apparently obtained from early official publications affording information regarding the *earliest* measurements of the bores referred to. These measurements were of a very approximate nature, and are not now regarded as reliable. The following table is based upon the latest measurements made by the Public Works Department, and sets out the horse-power that would be available from these bores if it were desired to utilise them for the development of power at the present time. A further deduction would, however, have to be made on these figures if the brake horse-power were converted into electrical power.

Name of Bore.	Maximum Pressure in lb. per square inch.	Equivalent Head, in feet.	Flow, in gallons. Per day.	Flow, in gallons. Per annum.	Brake Horse-power, 80 per cent. efficiency.
Belalie	76	175	107,348	75	0·8
Enngonia	85	196	163,497	114	1·4
Gil Gil	84	194	607,247	422	5·0
Pilliga	82	189	943,490	655	7·5
Tooloora .. .	18	41	345,495	239	0·6
Careunga .. .	116	267	637,124	442	7·2
Oreel	150	346	1,083,735	753	15·8

Moreover, the Public Works Department points out that the maximum horse-power is only available when the discharge of a bore is shut off to about half its normal flow. This would mean the sacrifice of half the daily flow to obtain the results shown in the table. Reliable measurements also indicate that both the flow and the pressure of the bores named are gradually decreasing.

It seems therefore probable that if the manufacture of nitric acid from the atmosphere is to be utilised to obtain a corrective to the alkali in the bore waters, some other source of power than the pressure of the bores will be required.

Turkeys: In Health and Disease.

G. BRADSHAW AND A. L. WYNDHAM.

Introduction.

It is generally believed that the domestic turkey was unknown in England or other European countries prior to the discovery of America; but in the exploration of that great country, this giant of the poultry-yard was found distributed throughout the immense area from Canada to Mexico.

The earliest description of the turkey was written by Ovieda, a Spanish historian, in a summary of the history of the Indies, and it is said that the first of them to leave their own country were sent to Spain early in the 16th century. From Spain they were introduced into England about A.D. 1524, although some writers say a few years earlier than this date. On the other hand, it is stated in "Norfolk Archæology," that the family of Sir George Strickland, Bart., have a tradition that one of their ancestors brought the first turkeys to England, and the fact that the family crest is a turkey cock in his pride, gives some support to the claim.

Whatever the source of their introduction, there is no doubt that they began to be raised in England fairly extensively, for in A.D. 1541 they ranked as a delicacy with peacocks and swans. Archdeacon Cranmer, in his ordinances for the regulation of feasts, decreed that only one dish should appear at each, and turkey was on the list.

Old records say they were served at a banquet in A.D. 1555, and in the 1585 edition of Tusser's "Five Points of Husbandry" appears the following:—

> "Good bread and good drink, a good fire in the hall,
> Brown pudding and souse, and good mustard withall,
> Beef, mutton, and pork, shred pies of the best,
> Pig, veal, goose and capon, and *turkey* well drest,
> Cheese, apples, and nuts, jolly carols to hear
> As then in the country is counted good cheer."

In 1587 the price of turkeys was such as to suggest plentifulness, for in the inventory made of the goods of one William Servison is the following:—

> "One turkye coke, and four turkey hens, and six young turkeys, 13s. 4d."

Shakespeare, about this time, also refers to them in his plays "Henry IV," "Twelfth Night," and "Henry V," showing that Shakespeare was fairly well acquainted with this, at the time, comparatively recent introduction.

At a feast recorded in 1685, fourteen turkeys cost but £1 11s. 6d., and from that time the price gradually rose till 1805, when the author of "A View of Agriculture, Co. Kent," says:—

> "Geese, turkeys, fowls, and ducks are bred in the country sufficient to supply the inhabitants, and a few to spare for the ships sailing to Gravesend. The price has much increased, turkeys now selling as high as 6s."

It may be further remarked that from that period their flesh became still more appreciated until the present day, when at certain seasons, in our own market, a 20-lb. gobbler will fetch 25s., or as much as a couple of 50-lb. sheep.

Nomenclature.

The only specimen of the native American fauna which has been subjected to domestication is the turkey. How, or by what means, it was brought to man's subjection is unknown, while the origin of its name, apparently Asiatic, remains a mystery. Some writers suggest that it was brought from Mexico to Spain by Moors; and as the Moors at that time were known in England as Turks, the big bird from America became known as the turkey or turk. Another theory is that the bird was imported by some of the Levant traders, when its identity became lost under the general designation of "Turkey"—a prefix at that time indiscrimately applied to coffee and other importations, although not the produce of the country named, nor in any way connected with the East.

Martin Doyle, a poultry authority of sixty years ago, says:—

> "Why the name of turkey was given to this bird is not clear. It may have acquired it by having been brought to England by merchants whose principal commerce was with Turkey and other ports of the Levant, and who traded with the Indies."

Other writers consider the name came from a resemblance of the red carunculations on the bird's head to the old Turkish red fez. Again, there is the suggestion that the word is a corruption of turquoise, a colour which the carunculations assume when the bird is excited. But whether any of the suppositions are correct, matters little; we have the bird, which, if given adaptable conditions, is the most profitable of the whole poultry tribe.

Breeds of Turkeys.

Although we have now several distinct breeds of turkeys, it is usually believed that they are all descendants of the wild turkey of America. The largest, the most profitable, and certainly the handsomest of them all is the American Bronze—not "Bronzewing," as some of the Agricultural Societies catalogue them. Following this, there is the Black Norfolk, which until recent years was largely bred in England, and was the principal variety bred for the Christmas market; and the Cambridge, in colour black, bronze, and white variegated. In addition to these there were numbers to be found in England, of a pure white colour, buffs, fawns, yellows, and slate colour, few of the last-named exceeding 18 or 20 lb. In America, Whites are bred to a moderate extent, and while not reaching the Bronze in weight, the gobblers often go to 30 lb. or over. The Whites in England are termed "Austrian Whites," while in America they are known as "White Holland" turkeys; but these names were acquired without any connection with the countries mentioned.

Another breed, confined solely to America, is named the Narragansett. This bird is of a black colour, while in size, though larger than the White Holland, it is not as large as the Bronze; neither is it so plentiful in that country as the Bronze or the White.

All of the above breeds and varieties have at one time or other been introduced into Australia, the majority of the ordinary stock bred in the country for the local or export trade being allied to one or other of them. The only ones of pure ancestry here are the Bronze. A considerable number of the flocks of Bronze Turkeys are due to purchases from Wagga Experiment Farm, whose occasional importations have not only been responsible for the annually increasing flocks of pure-breds, but through the distribution of single gobblers have assisted in putting in stamina, and increasing the size of large numbers of the hitherto diminutive, ill-bred specimens so plentiful in the State.

The Wild Turkey.

When full grown, the wild turkey is about 4 feet in length. The bill is short and strong, reddish in colour, and covered at the base by a cere-like membrane. The head is small in proportion to the body, and about half the neck is covered by a naked bluish skin, on which are a number of warty elevations. The neck is of moderate length; the body thick and covered with long, truncated feathers, dusky underneath, but succeeded with an effulgent metallic band changing to golden-bronze, and again merging into purple or black, according to the light. The lower portion of the back is less brilliant. The upper tail coverts are of a bright colour, with narrow bands of shining green. The smaller wing coverts are coloured like the feathers of the body. The primary coverts are banded with white. The tail is mottled with black, and crossed by narrow bands of the same colour.

In old birds the exterior web is much worn by friction amongst the bushes, which gives the feathers a singular unwebbed appearance. The tail measures more than a foot and a quarter, and is composed of eighteen feathers, which are capable of being expanded and elevated to resemble a fan. The tail is mottled with black, and crossed by narrow undulated lines of the same colour; near the tip is a black line.

The wild hen turkey is considerably smaller than the male, being 3¼ feet long. The bill and feet resemble those of the male, but are smaller. All the plumage is a subdued shade of the colour of the male bird, the bronze being scarcely perceptible.

Mr. J. J. Nolan, a naturalist and poultry exhibitor in the forties, gives the following description of the wild turkey and its habits:—

"The wild turkey inhabits the entire extent from the north-western territory of the United States to the Isthmus of Panama. In Canada and the now densely-peopled parts of the United States, wild turkeys were formerly very abundant, but like the Indian and buffalo they have been compelled to yield to the destructive ingenuity of the white settlers, often wantonly exercised, and seek refuge in the remotest parts in the interior. The wild turkeys do not confine themselves to any particular kind of food. They eat maize, all sorts of berries, fruit, grasses, beetles, and even tadpoles; young frogs and lizards are occasionally found in their crops. Their more general predilection is, however, for the acorn, on which they rapidly fatten.

"In October the males associate in parties, numbering from ten to a hundred, and seek their food apart from the hens; whilst the latter either move about singly, or with their young, then nearly two-thirds grown, or in company with other hens and their families form troops, sometimes consisting of seventy or eighty individuals, all of whom are intent in avoiding the old males, who, whenever opportunity offers, attack and destroy the

young, by repeated blows on the skull. All parties, however, travel in the same direction, and on foot, unless they are compelled to seek their individual safety, by flying, from the hunter's dog, or their march is impeded by a river. When about to cross a river, they select the highest eminence, that their flight may be more certain, and here they sometimes remain for a day or more, as if for the purpose of consultation, or to be duly prepared for so hazardous a voyage. Early in March they begin to pair, and for a short time previous the females separate from and shun their mates, though the latter pertinaciously follow them, uttering their gobbling notes. During this ceremonious approach the males often encounter each other, and desperate battles ensue, when the conflict is only terminated by the flight or death of the vanquished. This pugnacious disposition is not to be regarded as accidental, but resulting from a wise and excellent law of Nature, which always studies the good of the species, without regard to the individuals. About the middle of April the female turkey selects a place in which to deposit her eggs, secured from the encroachment of water, and as far as possible concealed from the watchful eye of the crow. The nest is placed on the ground, either on a dry ridge, in the fallen top of a dead leafy tree, under a thicket of bushes, or by the side of a log. It is of very simple structure, composed of a few dried leaves. In this receptacle the eggs are deposited, sometimes to the number of twenty, but more usually from nine to fifteen. They are whitish, spotted with reddish brown, like those of the domestic bird. The hen always approaches her nest with great caution, varying her course so as rarely to reach it by the same route, and on leaving her charge, she is very careful to cover the whole with dry leaves, with which she conceals it so artfully as to make it extremely difficult, even for one that has watched her movements, to indicate the exact spot; hence few nests are found and these are generally discovered by fortuitously starting the female from them, or by the appearance of broken shells scattered around by a fox or crow.

"When laying or setting, the turkey hen is not readily driven from her post by the approach of apparent danger, but if an enemy appears, she crouches as low as possible and suffers it to pass.

"They seldom abandon their nests on account of being discovered by man, but should a snake, or any animal suck one of the eggs, the parent leaves them altogether. If the eggs be removed, she again seeks the male and recommences laying, though otherwise she lays but one nest of eggs during the season. Several turkey hens sometimes associate, perhaps for mutual safety, deposit their eggs in the same nest, and rear their broods together.

"Mr. Audubon once found three females sitting on forty-two eggs. In such cases the nest is constantly guarded by one of the parties, so that no animal dare approach it.

"In proportion to the abundance or scarcity of food, and its good or bad quality, the birds are small or large, meagre or fat, and of an excellent or indifferent flavour; in general, however, their flesh is more delicate, more succulent, and better tasted than that of the tame turkey.

"The Indians value this food so highly, when roasted, that they call it the white man's dish, and present it to strangers as the best they can offer."

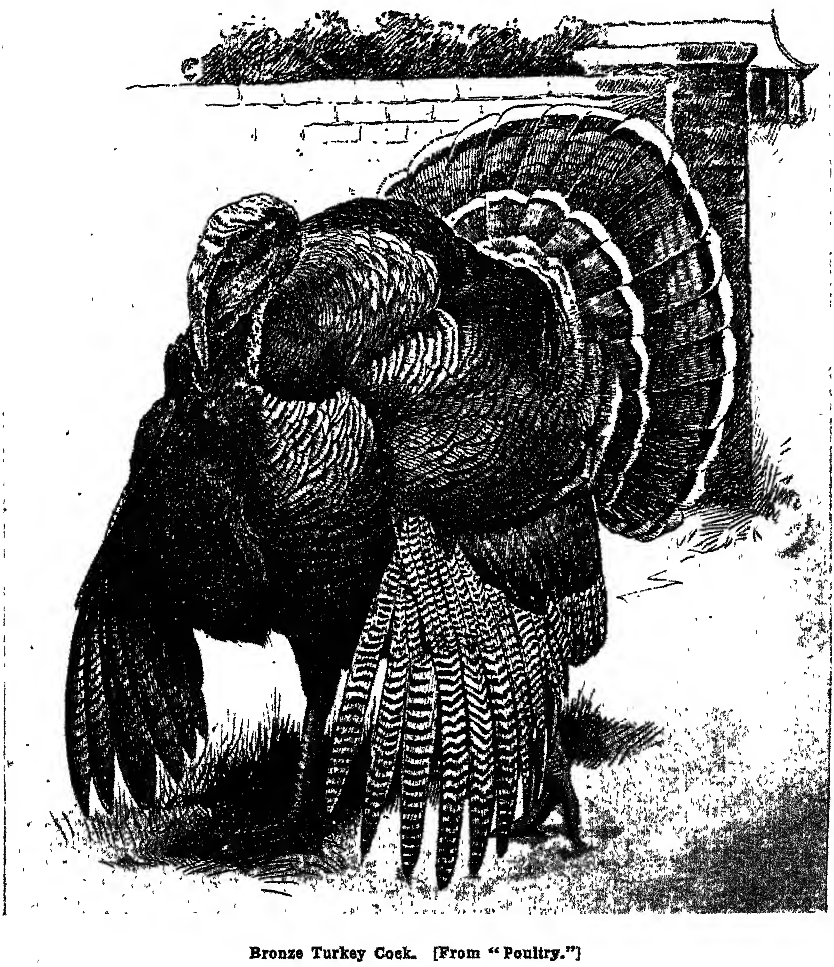
The above interesting particulars of America's largest and fast disappearing bird, was penned over sixty years ago. Perhaps the best recent description is that of Miss B. M. Tyson, in a late issue of the American "Poultry World":—

"Wild turkeys, once plentiful throughout the eastern portion of our country, are now nearly extinct within this area, with the exception of a few localities where the original forest has not been ruthlessly destroyed. Wild turkeys have again become a matter of special interest to Americans, more especially as breeding stock, than as wild game to be hunted. In shape the wild birds are much taller than the bronze, considerably longer bodied, and very neat and trim in appearance. Their shape, as compared to other varieties of turkeys, may be said to be as the Leghorn shape is to the heavier breeds of fowls. This is, no doubt, due to their agility and alertness, to exercise in flying, and to their way of living in the wild state. They experience no difficulty in flying to the top of tall trees. The legs of the wild birds are nearly twice the length of those of the domestic varieties, they are of a pinkish-red colour, and the feathering of the thighs is different; the feathers are very small, fit closely, and are of a light shade of brown. The flight feathers of the wings are narrower than those of the domesticated turkeys, and the wings are very strong.

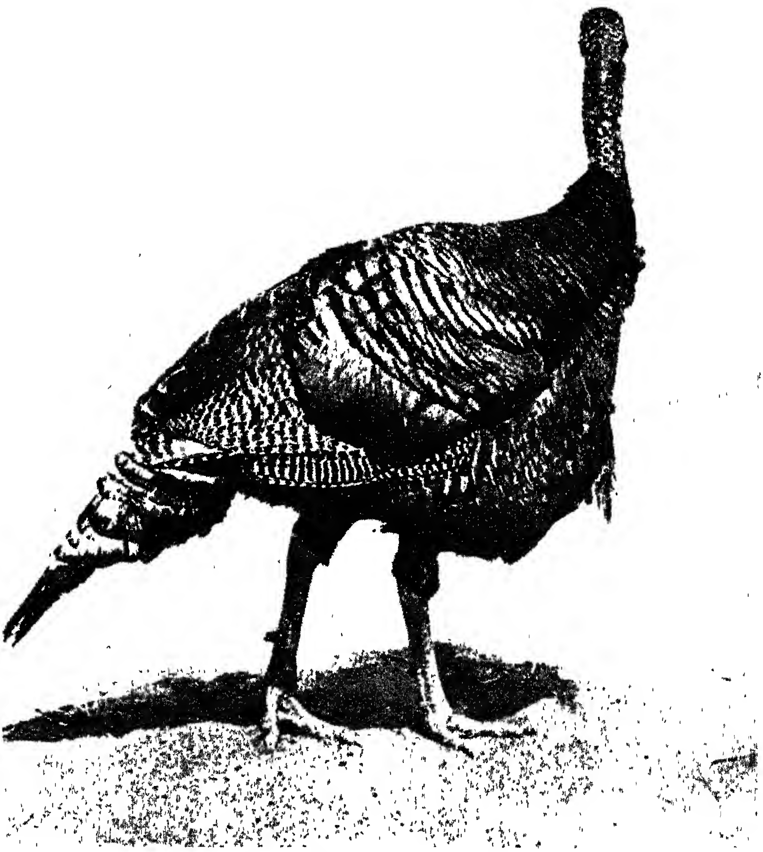
"The head is much smaller, and has not as much colour. The eye is very large and full. They are ever on the alert, and to say they have a 'watchful eye' is hardly putting it strongly enough. They never seem to lose sight of the fact that they are being hunted down, and are ever on the defensive. The dewlap is much smaller, and

there are very few caruncles on the head; this causes the head of the young birds to be so similar that it is often difficult to determine the sexes until they are fully matured. Wild turkeys are very quiet, and make little noise. The male birds seldom gobble until the breeding season is well on. After mating the hens are on the lookout for a secluded spot to make nests. They go off early in the morning direct from the roost, and to be successful in finding a wild turkey's nest, one must be an early riser, for they are off as soon as it is light enough to see. At all times they are more dignified and stately than the domestic turkeys, and have more the carriage and character of the pea-fowl.

"The plumage of the wild birds is exceedingly handsome; the beautifully harmonising combination of the green bronze, with its glints of purple, red, and orange, and the wide band of black near the edge of the feathers, combined with the lovely soft brown fringe, all join in making them distinctly beautiful. The beauty of their plumage is, no doubt, the result of their outdoor living—their coming in contact with the elements; for I have noticed that domestic turkeys of the bronze variety lose much of their brilliancy when housed. Another reason for this beauty of plumage is the state of the turkey's health. Wild turkeys are hardier than domestic varieties; their manner of living for generations has strengthened them; and this has added beauty to the plumage."



Bronze Turkey Cock. [From "Poultry."]



American Bronze Gobbler (Imported).

The Bronze.

This variety is often called the "Mammoth Bronze," deriving the first adjective from its immense size, and the second from its colour, which is a beautiful bronze green, banded with gold, red, and blue, glistening in the sun. They owe their great size and colour to the wild variety, described above, some of the American strains being direct descendants of pure wild birds, while others have about three-fourths wild blood in them. Specimens of the variety have been known to scale 50 lb. and over, and it is no uncommon occurrence for eight-months old birds to weigh 30 lb.

For exhibition purposes, size and colour are the chief considerations, a minimum weight of 34 lb. being provided. The standard colours are—Neck, back, and breast black, shaded with a glistening bronze, the under-

parts less richly coloured. Wings black, barred with white or grey, and edged with white; the wing bow having a greenish-brown lustre. Tail black, with brown pencilling, and the coverts grey, shading into black. Face, ears, and wattles a rich red, and the legs long and dark in colour, but inclining to pink as the birds get older. In hens the colour is less pronounced.

As a market bird the Bronze is the favourite, no doubt on account of its great size. At the same time a 30 or 35 lb. gobbler, if constitutionally sound, is quite large enough for breeding purposes, and those who cannot or will not discard their flock of mongrels, can repay themselves fourfold, by the introduction of a Bronze gobbler, of even lower weight than those mentioned.

The White.

The White Holland is a turkey which of late years has grown in popularity in America. They are frequently described as being of small size and delicate; the standard, however, provides that the cocks must be at least 26 lb., and specimens have been seen both in England and America reaching considerably over that weight. A few years ago a trio of this breed were imported by the Poultry Requisites, Sydney, and if the gobbler weighed according to his appearance, he must have been 30 lb. or over.

The late Lewis Wright says:—"The white turkeys can be traced back in England for over 100 years, particularly in Sussex, where they were much esteemed for their feathers. They were also to be found in other parts of the country, but never in great flocks. A peculiarity of this breed is, that while the plumage must be pure white, the tassel or tuft on the breast is always black. The shanks and feet are pink, and the flesh is as white as that of the Dorking fowl. Some writers assert that the White Holland, and a smaller white breed, named the 'Austrian,' are one and the same, the difference being only in size, while not a few are determined that they are distinct breeds."

The Cambridge.

The Cambridge turkey, once so popular in England, is a dull black or bronze, with some white markings. Adult cocks weigh from 20 to 26 lb., and before the introduction and crossing with the American Bronze, were the exhibition turkey of England. As far back as 1852 a Cambridge gobbler was exhibited at Birmingham Show, weighing 22 lb., and in 1865 a bird of the same breed at the same society's show scaled 30 lb. From that period the English breeders began to largely import the American Bronze, for crossing with the Cambridge, the result being so satisfactory that a pure-bred Cambridge can now hardly be obtained in England.

The Norfolk.

The Norfolk is the old black turkey of England, and of a smaller size than the Cambridge, pure-bred specimens being very handsome. It is reputed

to be of finer flavour than any of the other varieties, but is considered more delicate, and great care has to be given in the early stages of the young turkey's growth.

The plumage is of a metallic black, the beak dark-brown, and the shanks and feet lead colour. It is said this breed has deteriorated in size, through the Norfolk farmers sacrificing their best birds for the Christmas market; and when the Bronze was utilised it was usually crossed with the Cambridge.

The Italian.

The turkey bearing the above name is a small grey-black bird, attaining the weight of 12 to 15 lb. It is used in France largely for incubation purposes, the hens being persistent setters, frequently brooding from three to six months without interruption.

The Narragansett.

The above is a purely American variety, and equals the White Holland in size. The colour is black with a light bar near the end of each feather, the tip of the feather being black. It is said the birds are handsome and fairly popular, but are rarely seen beyond the States, and are most plentiful amongst the Rhode Island breeders. Only a few of these have reached England, and they are unknown here.

Fawns, buffs, and lavenders are "sports" or crosses, rather than breeds, and complete the domestic varieties.

(To be continued.)

List of Fertilisers in New South Wales [1910 List].

On page 320 of our April issue the manurial value of Messrs. Geo. Shirley Limited's Superphosphate, 36–38 per cent., is given as £4 17s. 10d.

This is a typographical error, and should be £4 7s. 10d.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Meerschaum Vale.	8 June, '10.
" ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
" ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Wollongbar Farm.	†
" ...	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm ...	*
" ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
Guernsey ...	Gentle Prince ..	Rose Prince ...	Gentle ...	Rous Mill... ...	5 Sept., '10.
" ...	The King's Mirror	Calm Prince ..	Vivid (imp.)...	Cumbalum ...	Oct., '10.
" ...	Prince Edward..	Rose Prince ...	Vivid ..	Casino	24 May, '10.
" ..	Star Prince ...	Calm Prince ..	Vivid ...	Dunoon	3 July, '10.
" ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	South Woodburn..	21 Sept., '10.
" ...	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Alstonville ...	20 Aug., '10.
" ...	Claudius ...	Golden Star II..	Claudia's Pride.	H.A.College, Richmond	*
" ...	King of the Roses	Hayes' King ...	Rose 8th ...	Berry Farm ...	*
" ...	Parson's Hope	Clatford Hope 2nd	Parson's Red Rose 2nd.	Wollongbar Farm.	*
Red Poll ...	The Judge ..	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
" ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
" ...	Auchenbrain Spicy Jock (imp).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
" ..	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
" ...	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ..	Wollongbar Farm.	*
" ...	Emerald's Mischief.	Prince Emerald	Miss Prim ...	H.A.College, Richmond	*
" ...	Dado	Daniel	Dot	" "	*
" ...	Dan of the Roses	Daniel of Auchenbrain.	Ripple Rose...	" "	*
Kerry... ...	Bratha's Boy ...	Aicme Chin ..	Bratha 4th ..	Glen Innes Farm...	†
"	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 2nd May, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

HOLSTEINS.—Maastricht: sire, Obbe II; dam, Lady Margaret; calved 26th June, 1908; price, £15.

Count Wittereen: sire, Obbe II; dam, Lolkje Zuyder Zee; calved 27th November, 1908; price, £15.

JERSEY.—The Nile: sire, Berry Melbourne; dam, Egypt's Glory; colour, whole; calved 1st S-ptember, 1909; price, 25 guineas.

Egypt's Glory is by Sir Jack from Egyptian Princess (imp.).

Sir Jack was sold by auction at the last Sydney Show for 170 guineas, the highest price ever given for a Jersey bull in New South Wales.

WOLLONGBAR EXPERIMENT FARM.

GUERNSEYS.—Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909; price, £45.

Sky Pilot: sire, Prince Souvia; dam, Parson's Red Rose II (imp.); 6751, from Parson's Red Rose, 2813, by Gil Blas, 1679; calved 7th May, 1909; colour, lemon and white; price, £50.

Admiral du Preel: sire, The Admiral; dam, Hayes' Lily du Preel IV (imp.), 6903, from Hayes' Lily du Preel III, 6166, by Hayes' Royal, 1674; calved 4th April, 1909; colour, lemon and white; price, £45.

HOLSTEIN.—De Wet: No. 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909; price, £10.†

The prices indicated are at the places named, or on rail.

H. C. L. ANDERSON,
Under Secretary.

† Applications for this bull will be held till 21st May. If more than one application be received, his disposal will be decided by ballot.

Orchard Notes.

W. J. ALLEN.

May.

Where it is intended to plant deciduous trees, either as refills or planting out a new orchard, no time should be lost in getting the land into a fit condition to receive them. Land should be cleared, well fenced, ploughed, and subsoiled. Lay the orchard out properly, give the trees plenty of room, so that there will be a sufficient area from which they will draw moisture to keep them in good growing condition during dry years. At time of planting cut all apple and pear trees down to within 1 foot of the ground, and other trees to within 15 inches.

Ascertain the varieties of fruits which find most favour on the markets, then select such kinds as will thrive best in your soil and climate. After planting, work, manure, and prune these in the most up-to date manner. Do every part of the work thoroughly, and you will not be disappointed in the ultimate results. Lime is beneficial to soils which are sour.

From now until pruning is a slack time, and it is well to give the orchard a good rest until that time. Stable manure may be carted in for weak trees. Drains, fences, gates, or any repairs necessary may be attended to.

Lemons and mandarins will soon be ready for picking.

Commence pruning in colder parts. Remove old dying or dead trees. Trees may be planted this month.

Varieties of Apples and Pears.

During the month of March I visited a few of the apple-growing districts, including Batlow, Goulburn, Tallong, Wingelo, and Penrose. I found the Five Crown apple doing exceptionally well in all of these places, and particularly so in the Tallong, Wingelo and Penrose districts, where it develops a beautiful pale colour, and grows to an enormous size. Jonathan and Buncombe were also doing well, while Rome Beauty, though cropping well from Goulburn to Penrose, did not appear to be suitable for Batlow; and is very subject to woolly aphis in all districts. The Yates apple attains a better size (and is therefore of greater commercial value) at Penrose than in any other district in which I have seen it growing in this State. In most places it never attains a saleable size.

With regard to pears, I found the Winter Cole, Bartlett, Josephine de Malines, and Idaho a few of the best to grow in any of the colder climates.

Cold Storage of Apples.

Last year an experiment was made with apples from the orchard at the Bathurst Experiment Farm to ascertain whether it would pay growers to hold fruit in cold storage until late in the year, and then place it on the

market against the imported American apples. For this purpose, 60 cases of apples were sent from Bathurst to the New South Wales Fresh Food and Ice Company, Limited, Darling Harbour, and placed in store on the 17th June, 1909, the market values for that week being noted from other sales. On the 23rd October, 1909, the fruit was delivered to Mr. F. Chilton, Belmore Markets, for repacking and sale. In packing, three cases were lost, mostly through blemishes on the skin.

The following figures show the economic results :—

Apples sent to Cold Store.

	£	s.	d.
30 cases Granny Smiths, at 8s. 6d per case	12	15	0
14 ,, Stone Pippins, at 6s. 6d. ,, ...	4	11	0
16 ,, Rome Beauties, at 8s. 6d. ,, ...	6	16	0
Railway freight, Bathurst to Sydney	1	2	9
Cartage, Darling Harbour to F. F. and I. Co.... ...	0	4	0
Cold Storage, 1d. per case per week, 18 weeks... ...	4	10	0
Cartage, F. F. and I. Co. to sales	0	4	0
Commission, F. Chilton	2	16	1
Total	£32	18	10

Losses : Two cases Granny Smiths ; one case Rome Beauties.

Value of Sales.

	£	s.	d.
28 cases Granny Smiths, at 14s. per case	19	12	0
5 ,, Rome Beauties, at 15s. ,, ...	3	15	0
2 ,, ,, ,, at 14s. 6d per case	1	9	0
8 ,, ,, ,, at 14s. per case	5	12	0
14 ,, Stone Pippins, at 10s. ,, ...	7	0	0
Total sales	£37	8	0
Total cost	32	18	10
Profit	£4	9	2
Interest on £24 2s. for 5 months, at 5 per cent. ...	0	10	1
Net profit	£3	19	1

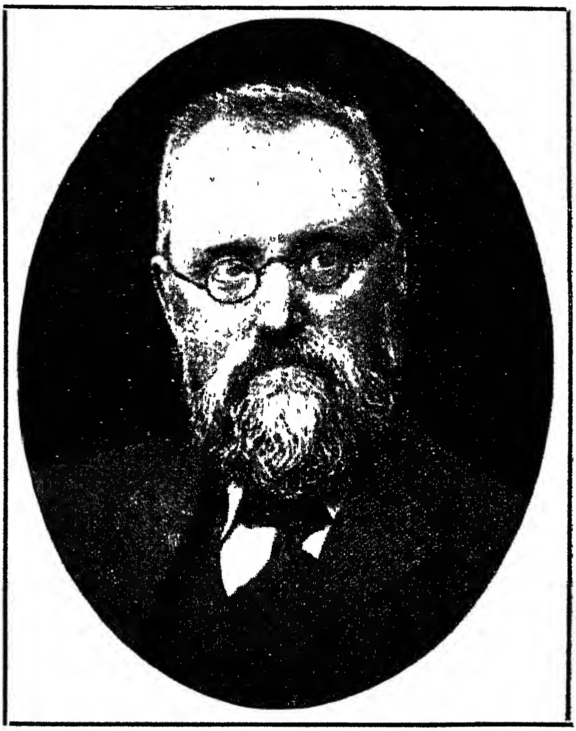
The cost, including freight, for the cold storage of the sixty cases averages 2s. 11d. per case, and the experiment shows that a net profit of 1s. 4d. per case is made. The apples were stored for 18 weeks.

The charge of one penny per case per week is rather high for the storing of fruit for several months. In Victoria apples are held in quantities at about one shilling per case for nine months—that is by the thousand cases. When our growers have the fruit for storing I feel quite sure that the Sydney cool stores will be able to cold store the fruit at even lower rates than our Southern neighbour.

THE "FARRER FUND."

An Appeal to Australian Millers and Wheatgrowers.

THE "Farrer" Fund, inaugurated with the object of creating some appropriate memorial to the late Mr. William Farrer, Wheat Experimentalist of the Department of Agriculture, has now reached £320.



The Committee appointed to control the Fund are anxious to invest the money permanently, so that the interest may go towards a bursary for some farmer's son or other lad showing special aptitude for experimental work with

wheat, to enable him, first, to study at one of the Farm Schools, and perfect himself, more especially in wheat-farming; then to proceed to the Hawkesbury Agricultural College; and, finally, it is hoped, to take advantage of the full course for B.Sc. in Agriculture at the University. A young man thus trained in practical and scientific work for seven years should be a very valuable man to the State, an excellent assistant to the present Experimentalist, Mr. G. L. Sutton, and a worthy successor to Mr. Farrer. But the amount already raised is insufficient to educate a lad through such a course of study, which would absorb £200 in fees, without taking into account the cost of board and lodging for a country lad while attending the University course for three years. In order to give a thorough training to one student every seven years, we need a capital sum of £1,000, which would ensure a worthy "William Farrer" scholarship or bursary, the expenses of which would amount to £20 for the first year; £25 for each of the next three; and £50 for each of the last three.

The Committee, therefore, wish particularly to urge those who have promised subscriptions to send them in at once, in order that clerical labour may be saved, the fund closed at an early date, the proceeds invested, and a student selected.

The Victorian Director of Agriculture has lately announced publicly that "Federation," one of the Farrer wheats, has added £250,000 to the value of the last Victorian wheat harvest. The champion prize given by the South Australian Government for the best wheat has been won by "Comeback," another Farrer wheat. West Australia has also found some of these wheats very valuable. They have also aroused great interest in Great Britain, the United States, and South Africa, where they are being tried by scientists, millers, and bakers. May we not look to Victoria, South Australia, and the other States which have likewise benefited, for co-operation in our effort to honour a good Australian citizen's memory?

Let us here commemorate the names of some of the best wheats bred by Mr. Farrer—Bunyip, Comeback, Bayah, Firbank, Federation, Bobs, Thew, Florence, Nutcut, Rymer, Cleveland, John Brown, Jonathan, Cedar, Warren, Uppercut, Jumbuck, and Genoa.

All our millers recognise the superior milling value of a number of these wheats, in proof whereof some of them have already given a subscription when personally approached on the subject. Will not all the millers do likewise?

The banks, financial institutions, and many of the wheat-farmers have proved the value of Farrer wheats, especially in the last wheat season. I appeal to every one financially interested, whether a corporation or an individual, to give a subscription to the Farrer Memorial Fund.

H. C. L. ANDERSON,
Under Secretary.

Department of Agriculture,
Sydney, N.S.W., 21st April, 1910.

List of Contributions to the "Farrer Memorial Fund," received since 1st January, 1910.

Name.	Address.	Amount. £ s. d.
Messrs. Jas. Loneragan (Ltd.)	Gulgong	2 0 0
A. P. H. and I. Association	Cootamundra	2 2 0
Mr. Hugh Ross	Department of Agriculture	0 10 6
Mr. W. H. Webb	Hathrop, Bathurst ...	1 1 0
Mr. F. W. Darby	Spring Ridge, *via* Quirindi	1 1 0
Professor J. D. Stewart	Sydney University ...	1 1 0
P. A. H. and I. Association	Temora	5 5 0
Scottish Australian Investment Company ..	Sydney	10 10 0
P. A. and H. Association	Peak Hill	2 2 0
Farmers and Settlers' Association	Narromine	5 0 0
Massey Harris Co. (Limited)	Sydney	9 10 0
Messrs. Geo. Shirley (Limited)	Sydney	10 10 0
Mr. Geo. Valder	Department of Agriculture	1 1 0
Hon. S. W. Moore, M.P.	Secretary for Lands ...	5 5 0
Mr. John Shapland	Newcastle	0 10 6
Mr. O. Gray	Wedderburn, Victoria ...	1 1 0
		£58 10 0

Grand Prize Maize from Tumut.

In respect to the sample of maize from Tumut, which was awarded the Grand Prize for Maize at the Franco-British Exhibition last year, the grower, Mr. David Crampton, junior, of Eversley, Tumut Plains, says: "I secured this maize as Yellow Dent, but I have been growing it for about six years with Horse Tooth and Early Clarence, but have always been careful to pick pure seed and sow in separate plots of land. The sample exhibited was from a crop planted in October, 1907, and harvested in April, 1908.

"It was grown on a 10-acre plot of black river land. Stalks grew to a height of 10 feet—some cobs fully 8 feet above ground—and the yield was 75 bushels to the acre. It was very red in the pith. This variety has always proved a good yielder and a bright looking maize if planted early.

"The land was ploughed in September and harrowed twice, then allowed to lie until sowing time. Then it was cultivated twice, harrowed twice again, and rolled. Drills were made on the cross, first time 4 feet, second time 3 feet 9 inches, and the seed dropped by hand three or four grains at a place. The seed was harrowed in with iron harrows, and just when the plants were coming through the crop was harrowed again.

"I believe in working in maize early—as soon as you can distinguish the plants in the rows from end to end, but I am not an advocate of hilling, especially in dry seasons."

Mr. Crampton forwarded a sample of the same grain as that which the jurors at the Franco-British Exhibition declared was the finest they had seen from any country, and Mr. Geo. Valder, Chief Inspector of Agriculture, who has arranged for comprehensive maize-growing experiments this season, says it is exceptionally good.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Coonamble P. and A. Association	J. M. Rees	May 3, 4, 5
Cobar P. and A. Association	D H. Dunlop	,, 4, 5
Hawkesbury District A. Association (Windsor)	H. S. Johnston	,, 5, 6, 7
Warren P. and A. Association	A. C. Tompson	,, 11, 12
Merriwa A. and P. Association	V. Budden	,, 17, 18
Nyngan and District P. and A. Association	R. H. A. Lyne	,, 18, 19
Walgett P. and A. Association	S. E. Johnston	,, 18, 19
Brewarrina P. and A. Association	H. L. Cathie	June 1, 2
Deniliquin P. and A. Society	L. Harrison	July 21, 22
Hay P. and A. Association	G. S. Camden	,, 26, 27
Riverina P. and A. Society (Jerilderie)	W. Elliott	,, 26, 27
Narrandera P. and A. Association	W. T. Lynch	Aug. 3, 4
Corowa P., A., and H. Society	J. D. Fraser	,, 16, 17
Coolamon A. and P. Association	J. W. Skien	,, 17
Forbes P. A. and H. Association	H. J. Brooke	,, 17, 18
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 23, 24, 25
Murrumbidgee P. and A. Association	A. F. D. White	,, 23, 24, 25
Parkes P., A., and H. Association	G. W. Seaborn	,, 24, 25
Wyalong District P., A., H., and I. Association	T. A. Smith	,, 30, 31
Junee P., A., and I. Association	T. C. Humphrys	,, 31, Sept. 1
Young P. and A. Association	G. S. Whiteman	Sept. 6, 7, 8
Ariah Park P., A., H., and I. Association	A. T. White	,, 7
Germanton P., A., and H. Society	J. S. Stewart	,, 7, 8
Albury and Border P., A., and H. Society	W. I. Johnson	,, 13, 14, 15
Ganmain A. and P. Association	J. H. Ashwood	,, 14
Northern A. Association (Singleton)	H. A. Bennett	,, 14, 15, 16
Cootamundra A., P., H., and I. Association	T. Williams	,, 15, 16
Temora P., A., H., and I. Association	John Clark	,, 20, 21, 22
Lismore A. and I. Society	T. M. Hewitt	Nov. 16, 17, 18
Mullumbimby A. Society	N. Neilsen	Dec. 9, 10

1911.

Society.	Secretary.	Date.
Kiama A. Association	R. Somerville	Jan. 25, 26
Shoalhaven A. and H. Association (Nowra)	H. Ranch	Feb. 15, 16
Central New England P. and A. Association (Glen Innes)	G. A. Priest	Mar. 14, 15, 16
Goulburn A., P., and H. Society	J. J. Roberts	,, 16, 17, 18
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	April 5, 6, 7

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In Memoriam.

KING EDWARD VII.

BORN 9th NOVEMBER, 1841 DIED 6th MAY, 1910

The Minister and every officer and employee of the Department of Agriculture, in common with other loyal sons and daughters of the Empire, deplore the death of KING EDWARD VII.

Great Britain has lost a wise, just, and able Ruler, who ever showed a keen and wide interest in everything affecting the welfare of his millions of subjects, and who had a proper appreciation of the aspirations of the people and of the value of every class of worker in the interests of humanity.

The world has lost a powerful agent in the cause of peace and the progress of mankind, and our Empire has cause to mourn one who did much to restore and maintain the ancient prestige of British power in World Politics.

King Edward himself once said that "his own tastes would have made him prefer the life of a country gentleman rather than a throne." His home and retreat from the cares of office was at Sandringham, in Norfolkshire, where his success in the breeding of horses and cattle made him recognised as the greatest patron of agriculture in the Old Country.

He has been well called the "First Gentleman of Europe," but we will remember him as the "First Gentleman Farmer of the World."

The Department of Agriculture of New South Wales reverently places its laurel wreath on the bier of the Greatest Sovereign of modern times.

His life was gentle; and the elements
So mix'd in him that Nature might stand up
And say to all the world, "This was a man."

Agricultural Gazette of New South Wales.

Orchard Soils of the County of Cumberland.

H. I. JENSEN, D.Sc., Chemist's Branch.

IN order to ascertain the composition of soil known to be in the best condition for growing citrus fruits I visited various parts of the county of Cumberland and collected soil from some of the best orange orchards.

Most of these soils had been manured very heavily for a large number of years, and in accordance with the personal idiosyncrasies of the owners; hence no single one can be looked upon as absolutely representing the requirements of citrus fruits without exceeding that limit in one or other of the ingredients. Some are far higher in lime than necessary for successfully growing oranges, some in phosphoric acid. However, it is likely that the average of these analyses will represent very nearly the optimum for citrus fruit.

Table A gives the composition of these soils.

For comparison it is well to refer to Mr F. B. Guthrie's article on the "Virgin Soils of the County of Cumberland."*

In Table B, copied from that article, the average composition of the typical sandstone and shale soils in the virgin state is represented, and for further comparison the analysis of a friable volcanic soil, and the mean of the analyses of manured orchard soils of the county of Cumberland.

A glance at these two tables suffices to show that cultivation and manuring have completely altered both the mechanical and the chemical condition of both sandstone and shale soils. Originally very different, they have, by working and fertilising, been brought to the condition of good basalt soils, and original differences in chemical and mechanical composition have been almost eliminated.

It is clear from this fact that the ideal virgin soil for citrus fruit is a loose and friable basalt soil, such as would be produced by decomposition of felspar basalt, in which a sandy or porous texture is maintained by the resistance to weathering of soda felspar crystals. This is the secret of the success of unmanured orange orchards in the Jamberoo–Kiama district and in the Blackall Ranges, Queensland.

It is particularly interesting to see how the mechanical composition of the sandstone soils has been changed. The capillary power has been reduced from 9 to 7 inches, and the water capacity has been increased from 37·9 to about 41 per cent.; while the clay has increased from 18 to 66 per cent. The volatile organic matter has been raised by cultivation in the sandstone soils from 7·22 to 10·68 per cent., and in the shale soils from 7·62 to 11·96 per cent.

In the shale soils the capillary power has been increased from 5·2 to 6 in., and the water capacity reduced from 52½ to 48 per cent. The clay percentage has been slightly increased, and the volatile organic matter has increased as above stated.

As regards the fertilising substances, all of them have been greatly improved in amount by cultivation and manuring, and the sandstone soils have been brought to practically the same composition as the shale soils.

* See *Agricultural Gazette*, May, 1898, vol. IX, p. 481.

TABL A.—Citrus Fruit Soils, County Cumberland.

Locality	Geology.	Colour.	Reaction.	Capillary Power.	Water Capacity. %	Clay. %	Moisture. %	Volatile. %	Nitrogen. %	Lime. %	Potash %	Phosphoric Acid. %	Remarks.
Hornsby .. .. (Mr. Fear's orchard.)	Hawkesbury sandstone.	Light brown.	Acid	7 in.	41	55·6	4·64	8·32	·140	·306	·211	·349	Cultivated and manured about forty years.
Hornsby .. .. (Mr. Fear's orchard.)	do.	Dark	Faintly acid.	6¾ in.	46	85·6	7·34	11·52	·196	·598	·284	·270	As above, but sample taken in a gully or depression.
Castle Hill .. .. .. (Mr. Purser's orchard.)	Sandy shales of Wianamatta age.	Brown	Acid	8 in.	42	62·7	8·50	11·05	·196	·404	·123	·196	Cultivated and occasionally manured over sixty years, some of the trees being seventy years old and still bearing well. Limed and manured with bush scrapings at intervals.
Castle Hill . . .. (Mr. Purser's orchard.)	Sandy shales.	Dark	Acid	7 in.	36	59·6	3·64	11·83	·238	·330	·130	·145	
Castle Hill . .. .. (Mr. Purser's orchard.)	Typical Wianamatta shales.	Dark	Strongly acid.	6 in.	48	63·1	3 89	12 55	·140	335	·125	·208	
Thornleigh . .. (Mr. Withers' orchard.)	Wianamatta shales.	Brown	Faintly acid.	6 in.	47	81·5	7·45	12·25	·280	1·645	·231	·416	Orchard in good condition, and must have been recently heavily manured with bone fertilisers.
Thornleigh .. .. (Mr. Duffy's Nursery.)	Wianamatta shales.	Light brown.	Strongly acid.	6 in.	48	85·8	6·75	11·38	·182	·280	·200	·149	Not used at present for citrus fruit, but similar country in the neighbourhood is so utilised.
Thornleigh .. .. (Mr. Duffy's Nursery)	Wianamatta shales.	Light brown.	Strongly acid.	6 in.	46	71·8	5·50	9·90	·140	·322	·215	·159	This soil has been lightened with sand to make it suitable for raising orange trees.
Baulkham Hills .. .. (Mr. Allsop's orchard.)	Wianamatta shales.	Dark	Strongly acid.	6 in.	48	79·4	3 01	11·73	196	·200	·165	·125	In very fair condition; farmyard manure chiefly used.
Baulkham Hills .. .. (Mr. Bryant's orchard.)	Wianamatta shales.	Dark	Acid	7 in	51	73·6	5·33	13 97	238	·158	·079	·107	Young orchard; not long cultivated, nor heavily manured.
Average of Sandstone Soils.	......	Dark	Acid	good 7	fair 41	65·9	6·03	10·68	good ·192	good ·409	satis-factory ·187	good 240	Average of four sandstone soils (Nos 1 to 4) suitable for oranges.
Average of Shale Soils .	.. ...	Dark	Strongly acid	good 6	good 48	75·9	5·47	11 96	good ·196	good ·490	satis-factory ·169	satis-factory ·196	Average of six shale soils (Nos 5 to 10,.
Average of all the above..	..... .	Dark	Acid	good 6½	good 45	71·9	5·69	11·45	good ·195	good ·458	satis-factory ·176	good ·272	
Maximum and minimum percentages in the above.	In good orchard soils.	....	. . .	8	51	86	8·5	14 0	Optimum good ·200	Optimum good 500	Optimum good ·200	Optimum good ·200	The approximate optimum is given for manurial ingredients in preference to the maximum.
				6	36	59	3·6	1·3	satis-factory ·140	satis-factory ·200	satis-factory ·100	satis-factory ·109	

TABLE B.—Composition of Virgin Soils of County Cumberland.

Average Mechanical Composition, calculated from ten typical Shale and ten typical Sandstone Soils.						Average percentage of Fertilising Ingredients in Cumberland Soils (see F. B. Guthrie, *Agricultural Gazette*, 1898, p. 481).				
Geological Type.	Capillary Power.	Water Capacity.	Clay.	Reaction.	Moisture.	Volatile.	Lime.	Potash.	Phosphoric Acid.	Nitrogen.
Hawkesbury Sandstone	inches, excellent 9·2	per cent., fair 37·9	per cent. 18·8	acid	....	per cent. 7·22	per cent., satisfactory ·106	per cent., fair ·066	per cent., satisfactory ·137	per cent., satisfactory ·133
Wianamatta Shale	good 5·2	good 52·5	67·7	strongly acid	. .	7·62	satisfactory ·136	satisfactory ·133	fair ·096	satisfactory ·140
Average of all	good 7·2	good 45·2	43·3	acid	....	7·40	satisfactory ·121	fair ·099	satisfactory ·116	satisfactory ·136
Kiama Volcanic Tuff.—Virgin soil, for comparison with manured citrus fruit soils.	good 7	good 56	75·7	acid	5·30	12·85	good ·384	satisfactory ·157	satisfactory ·137	good ·238
Average of all manured orchard soils of County Cumberland.	good 6½	good 45	71·9	acid	5·69	11·45	good ·458	satisfactory ·176	good ·272	good ·195

Agricultural Gazette for June, 1909.

The stock of this number of the *Gazette* is exhausted, and the Department is particularly desirous of obtaining a few copies to complete files. The Editor will be obliged if any readers who have copies which they do not further require will kindly forward them to the Department.

Rhodes Grass.

(*Chloris virgata.*)

Mr. B. Harrison, of Burringbar, Richmond River, writes:—

As it may prove of interest to many stock-owners, kindly permit me to give a description of the above. This grass is rapidly coming into great favour throughout Australia, and the favourable reports of its great merits point to its extensive cultivation. It has proved a really wonderful grass for resisting drought, and will grow and remain green when many of the other species are burnt up. The famous Paspalum grass has hitherto been the leading grass with our dairy farmers, but to be a success, it requires fairly rich soil and a warm, moist climate, or artificial irrigation. In districts similar to the Tweed, where the soil is rich and the rainfall very heavy, the Paspalum grows so luxuriantly in the summer months that stock are in many instances unable to eat it down, and in the autumn months it becomes rank, and somewhat affects the flavour of the milk and butter. With Rhodes grass it is entirely different, as not only will it thrive well where the rainfall is light and the soil inferior, but at all stages of growth it is relished by stock, and does not deleteriously affect dairy products.

In the central dairying districts of Queensland, and the western portion of this State, where the climate is dry, Rhodes grass promises to be equally as great a boon to the settlers as Paspalum has been to those residing in our moist coastal country; and without doubt it will, in the course of a very short time, when its great merits become more widely known, prove one of the most beneficial and popular grasses yet introduced into Australia, as it can be so easily cultivated over such an immense area of land.

Judging by several years' experience, there is probably no other grass that will give such good and satisfactory results under adverse or trying conditions of soil and climate. The seed is very light and fine, and germinates readily with a small amount of moisture. About 5 lb. should be sufficient to sow one acre of land. After germination, the plant throws out strong vigorous runners, which root at each joint, after which the shoots grow erect to the height of 3 or 4 feet. It spreads rapidly, and presents a splendid waving mass of verdure that would delight the eye of the pastoralist.

It yields, according to soil and climate, from 5 to 10 tons of fodder per acre, which in feeding value ranks with sorghum, and is greatly relished by all classes of stock, which prefer it to Paspalum. It produces a large quantity of seed, which can be harvested easily; and, if necessary at any time, it can be ploughed out without much trouble. The thanks of many of our farmers will be due to the gentleman (Mr. Sylvester Browne, of Singleton) who first introduced it to this country from South Africa some years ago.

Codlin Moth and Haysheds.

A suggestion has been made that haysheds have an attraction for Codlin Moths, and there is a possibility of a simple means of restraining the pest being evolved if this is found to be the case. The Managers of the Experiment Farms where apples are grown, are making observations to see whether hay, either in the shed or in the stack, has any attraction for the moths; meanwhile the Department would be glad to know if any *Gazette* readers have found that the presence of hay near their orchards has influenced the moth in any way.

Insects which Damage Saltbush.

WALTER W. FROGGATT, F.L.S., Government Entomologist.

ALL stock-owners know the value of the different species of the genus *Atriplex*, commonly known as saltbush, and many, if not actually cultivating it, are now protecting it from overstocking. Consequently, any pest that damages this valuable fodder-plant, which once covered most of the great plains of the south and west, and is still to be found in conjunction with the natural grasses over an immense area in this State, is worth watching and investigating.

A few months ago, the writer gave a short report of his visit to the Hay district, where much damage had been caused to the saltbush by insect pests, and he now proposes to give an account of all the pests known to him found on saltbush.

The last extensive outbreak of saltbush-eating caterpillars was in the summer of 1899, when all the plains around and westward of Broken Hill were laid waste by an army of caterpillars belonging to the family *Noctuidæ*, which includes the cutworms and other well-known caterpillar pests. They appeared in such countless numbers that the ground was literally black with them, and thousands of acres of good fodder were destroyed. The reports received from many correspondents in the Broken Hill district were published at the time (*Agricultural Gazette*, February, 1901). The caterpillars that did all the damage ten years ago were identified, one as the "variegated caterpillar," the larva of the yellow and brown Day flying Moth (*Apina callisto*), and the other as the dull green caterpillar of the cosmopolitan (*Agrotis ypsilon*), known as the "Bugong Moth" in Australia.

During this last outbreak (1909), the whole of the saltbush over a very large area, in the Hay district in particular, and probably in other places unrecorded, was attacked by these and other caterpillars. They appeared in such enormous numbers that they left hundreds of thousands of acres of rich saltbush plains absolutely bare, with all the old saltbush practically dead, and until the self-sown seeds begin to germinate under the shelter of the dead bushes, there will be no fresh growth.

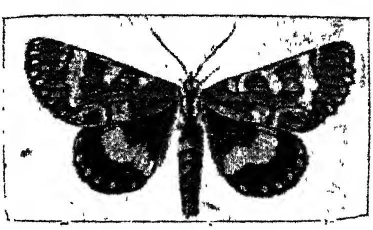


Fig. 1.—Day-flying Moth (*Apina callisto*).

It is noticeable that while all the saltbush on the high ground is dead, yet on some of the lower land, after the late rains, some of the bushes have made a fresh shoot in places, and may recover to a certain extent. The area, however, upon which these plants are absolutely dead extends over a great tract

of the best lands of these plains. Through the kindness of Mr. Scrivener, the District Surveyor at Hay, I was enabled to personally examine a great deal of "caterpillar killed" saltbush, and to obtain much valuable information; though at the time of my visit (November) all the caterpillars had vanished, for they had become full grown, and were buried under the soil in the pupal state.

I was told that they had spun webs all over the dead bushes before they went, but this impression I found originated from the appearance of small web-making spiders that had found the bare twigs admirable places to spin their webs, and thousands of dead bushes were draped with these delicate gossamer webs.

The number of caterpillars that had been feeding over these plains two months before could be judged by the number of pupæ obtained by pulling up the dead bushes, and turning over the soil beneath. Within a radius of 6 inches around the stem the naked, hard, brown chrysalids of the Bugong Moth were packed in dozens in the hard clay just below the surface; while in the looser ground, more on the surface, were the less abundant, stiff, silken cocoons. Enclosed in an outer parchment-like cover was a much larger pupa, which has since been bred out and identified.

The Banded Saltbush Moth.

Anthela (Darala) denticulata, Newm.

Newman described this moth many years ago in the Transactions of the Entomological Society of London, under the name of *Teara denticulata.* In Lower's List, published in the "Victorian Naturalist," 1894, it is recorded from Victoria, and Mr. Lyell says it is a common moth. This is the first time, as far as I know, that it has been recorded as a pest. I did not see the live caterpillars, but there were remains of many dead ones among the saltbush that resembled the spiny hairy larvæ of the "Day-flying Noctuid" (*Apina callisto*), which had previously been recorded as a pest on the saltbush; so I concluded that they were the remains of the caterpillar of the latter.

This handsome moth measures nearly 2 inches across the outspread wings, with the usual thick-set form and rounded wings of the group. The ground colour is dark brown, with three well-defined zigzag bands of white running around the outer half of both pairs of wings, two white dots in the centre of the basal half of the fore wings, and another little irregular band around the base of the wing. The first marginal band occupies the outer edge of both wings; the two following bands are well separated from the outer one by brown; the centre of the hind wings clouded with grey; and the antennæ grey and brown.

While digging out these pupæ, a number of large parasitic hymenoptera, belonging to the family *Ichneumonidae,* and commonly called Ichneumon wasps, were flying around the bushes, and later on in our breeding jars a number of specimens of the two large Ichneumons, *Rhyssa semipunctata* and *Pimpla intricatoria,* were obtained from the cocoons of this moth. These

parasites destroy about 25 per cent. of the pupæ of this cocoon-making moth, but do not appear to touch the naked pupæ of the Bugong Moth, probably because they are so much deeper in the ground, and thus protected against their attacks.

The Bugong Moth, and a Parasite.

The Bugong Moth is one of those cosmopolitan insects which are found in every part of the world where they can find food; and it has adapted itself to every condition of climate, from the snows of Hudson's Bay, in Canada, to the tropical climate of Ceylon and Java, and the dry hot plains of Australia. It is an omnivorous feeder, devouring all kinds of cultivated crops, fodder, and grass; and in this country it is one of the commonest and most destructive of our noctuid moth cutworms.

Early in December, 315 chrysalids dug out from under the saltbush at Hay were counted out and placed in a breeding jar, when it was noticed that a number of minute black parasites (chalcid wasps) were cutting their way out through the sides of the pupæ, and in a few days were swarming over the sides of the jar in thousands.

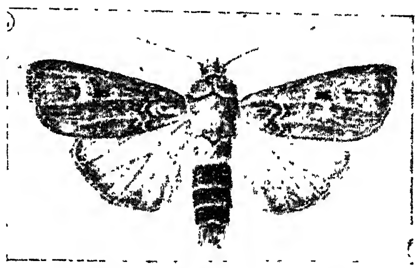


Fig. 2.—Bugong Moth (*Agrotis infusa*).

Careful examination on 10th January, 1910, gave the following results:—Eighty-three chrysalids were perforated with holes through which the parasites had escaped; four only contained dead adult moths; eighty-three had been attacked by some fungus (probably on account of unnatural conditions in the breeding jar); and the remaining 145 all contained the tiny parasites in varying stages of development.

Allowing that some chrysalids were damaged in removing them from the hard soil, the examination plainly shows that if the whole area is in the same state, the parasites have the upper hand, and all conditions being equal, it will be some years before these moths will reappear as pests. This minute black chalcid wasp—probably an undescribed species of one of the many genera into which the great family *Chalcididæ* has been divided by specialists, since the economic importance of the micro-hymenoptera has been understood—is so small that unless bred out in a glass jar it would not be noticed; yet, through its immense numbers (many thousands developed from the few hundred chrysalids), it has complete control of such a serious pest.

During our investigations it was found that a number of the dead saltbush twigs were infested with beetle larvæ. In some places a large percentage examined contained beetle castings, though in most cases the larvæ had pupated and then emerged as beetles, but enough specimens were obtained to enable us to breed out two very fine weevils. On examination, Mr. A. M. Lea, of Hobart, one of our well-known authorities on Australian weevils,

found that one was a new species of the genus *Belus*, of which I append a technical description; and the second, a species described many years ago, from South Australia. The most interesting point about these beetles is

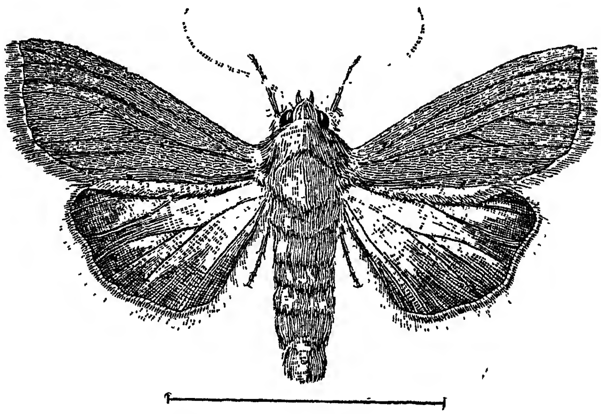


Fig. 3.—The Army Worm Moth (*Leucania unipuncta*)

that in both species the whole of the beetle is densely clothed with fine grey scales, which in coloration closely resemble the dull grey tint of the saltbush upon which they feed—a remarkable instance of adaptive coloration to enable them to escape the eyes of their many enemies.

The Oval Grey Weevil.

(*Elæagna squamebunda*, Pascoe.)

This beetle was described and figured by Pascoe in the Transactions of the Entomological Society of London in 1870, from specimens sent to him by Mr. G. Masters, who collected them at Port Augusta, South Australia. The co-types (two in number) are in the Australian Museum, but after forty years' exposure are very much darker than my fresh specimens, the grey scales having turned to a dull yellow tint.

The weevil belongs to the *Cryptorhynchinæ*, and is the sole representative of its genus. In Pascoe's description the generic name is spelt *Elæagna*, but in Master's catalogue the first "*a*" is dropped and is spelt *Eleagna*. I have followed the original description.

It is of a uniform grey colour, with a faint yellow tint on the wing covers. Viewed from above, the head is hidden, the thorax broad, rounded in front and nearly as long as the body, which is broadly rounded, making the whole insect of a regular, elongate, oval form. The surface of the thorax is very finely punctured all over, and the wing-covers have parallel striæ coarsely punctured. Measurement, $\frac{1}{5}$ of an inch in length. The larva feeds on the dead stems of the saltbush, working downwards towards the roots.

The Slender Grey Weevil.

(*Belus ursus, n.sp*, Lea.)

Dull reddish brown; head and upper surface of rostrum almost black. Densely clothed with rather long, depressed, whitish, uniformly distributed hair, or coarse pubescence, absent only from the apical half of rostrum and each shoulder.

Head with coarse, more or less concealed, punctures. Rostrum moderately curved, about the length of prothorax, apical half with numerous small punctures, basal half with large but concealed ones. Antennæ, for the genus, not very thin; first joint as long as second and third combined; third slightly longer and thinner than second; third, fourth and fifth of even width, the others gradually increasing in width; eleventh about one and a half times the length of tenth. Prothorax slightly wider than long, base wider than apex, and slightly wider than elytra, with a strong continuous median impression, and dense, more or less concealed, punctures. Elytra narrow, parallel-sided to near apex, which is gently and evenly rounded; suture not suddenly elevated at base, with coarse, more or less concealed, punctures. Front femora very stout, edentate, hind pair just passing apex of first ventral segment; front tibiæ with numerous small teeth, but the apical one rather large, the other tibiæ with smaller and sparser teeth. Length, 8 mm. Hay, New South Wales.

The dense pubescence uniformly covering both the upper and under surface will readily distinguish this species from all previously described ones. It is quite white on the under surface, legs, and on the sutural portion of the elytra, but somewhat stramineous elsewhere. In outline it is something like *pudices* and *vetustus*. The type is probably a male.

Two specimens of this curious weevil were bred out of infested twigs; the first from the long slender larva enclosed on the twig sent down from Hay by Mr. C. R. S. Scrivener; and a second from infested twigs collected when I was visiting the district. They had probably been plentiful a month or six weeks earlier.

The Saltbush Scale.

Pulvinaria Maskelli, Olliff, *Agricultural Gazette* of New South Wales, Vol. II, p. 667, pl. LXII, 1891; and Vol. III, p. 176, 1892.

This handsome scale insect was found doing a great deal of damage to the saltbush in the Wentworth district towards the end of 1891, by Mr. D. A. Morgan, Stock Inspector, who sent specimens to the Agriculture Department for identification. Mr. Olliff subsequently visited the district, and collected a large number of specimens, and on investigation found them to be an undescribed species of *Pulvinaria*, which he dedicated to Maskell, the great authority on *Coccidæ*, calling it *Pulvinaria Maskelli.*

In the following year, Olliff published a technical description of this scale insect, and figured two parasites which, under ordinary conditions, apparently keep this pest in check.

The first was a small moth, which he named *Thalpochares pulvinariæ.* In the caterpillar state it feeds exclusively upon different kinds of scale insects. The genus *Thalpochares* is represented by half a dozen species in Australia, of which the larvæ are all carnivorous, and destroy scale insects.

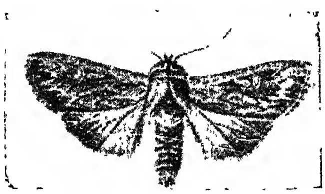


Fig. 4.—A Cutworm Moth (*Mamestra Ewingii*)

The second parasite was a lace-wing fly (*Chrysopa Ramburi*), which in the larval state is a most effective destroyer of all kinds of mealy bugs.

Since the saltbush scale was described we have often had specimens sent in from the saltbush country for identification, but as far as we know there has been no serious damage done to these plants by scale insects since 1892.

The Small Saltbush Moth.

(*Zinckenia recurvalis*, Fab.)

This is a very common moth in the western country where saltbush grows, and in the summer months they sometimes swarm into the lighted lamps at night in thousands. The slender little green caterpillar feeds upon the foliage of the saltbush, and with the advent of saltbush hedges into our suburban gardens has become very common about Sydney. One will often see these hedges stripped of every leaf in our gardens, the dense growth probably enabling the caterpillars to get away from insectivorous birds.

The moth has the fore wings of a uniform dark brown tint, with an irregular white band traversing the centre of each wing, and a second white spot at the tip of the fore pair.

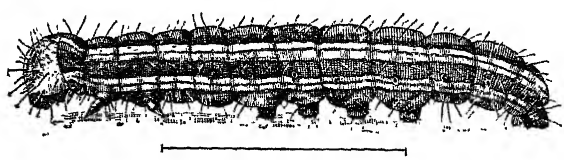
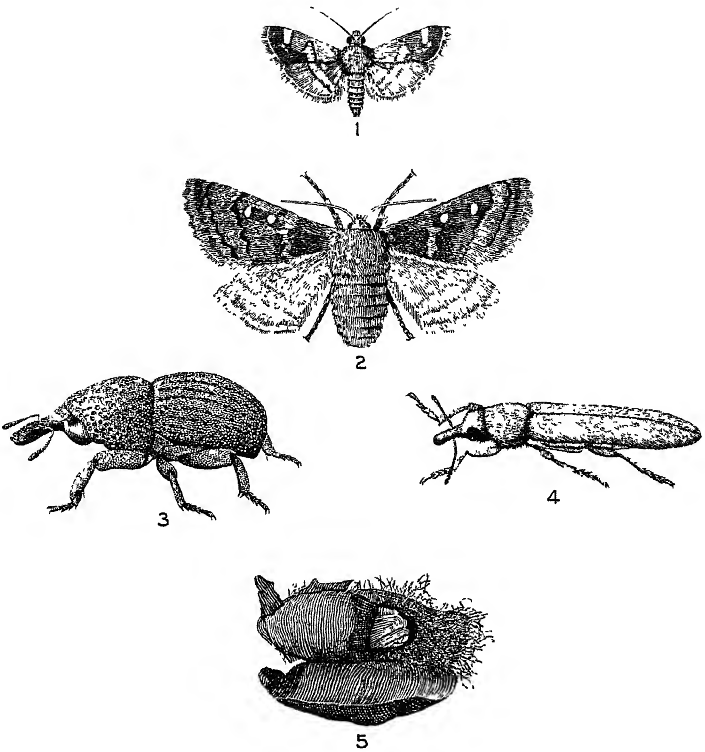


Fig. 5.—Cutworm.



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1. *Zinckenia recurvalis.* Natural size.
2. *Anthela (Darala) denticulata.* Natural size.
3. *Elæagna squamebunda.* × 7
4. *Belus hirsutus.* × 4
5. *Cocoon of Anthela (Darala) denticulata.* Natural size

SALTBUSH INSECTS.

Colic in Horses: its Common Causes and Emergency Treatment on the Farm.

C. J. SANDERSON, M.R.C.V.S., Government Veterinary Surgeon.

A CORRESPONDENT, writing to the Editor of the *Agricultural Gazette* recently, asks for information how to avoid colic by suitable feeding, &c., and also for some home remedies that might be beneficial in cases where drugs could not be obtained.

An article on "Derangements of the Digestive Organs in Horses" appeared in the January, 1910, number of the *Gazette*, page 11, and the treatment there advocated should still be followed, where possible, as any treatment now suggested is only to meet emergency cases, or to stop a gap till other and more effective remedies can be obtained.

As colic in one form or another is one of the commonest diseases of equines, and is responsible for the loss of a large number of horses annually, a few remarks on prevention will be of interest to horse-owners in general.

Owing to the fact that the term "colic" is applied to any abdominal pain, and that there is seldom any attempt made to differentiate between pain caused by such diverse causes as calculi, strangulated hernia, intussusception of the bowel, and pain caused by undigested food, it is certain that there will always be cases of colic reported.

The total amount of colic can be vastly reduced, however, by suitable feeding and watering, careful attention to the teeth, and working the horse on common-sense principles. No attempt will be made in this present article to deal with either of these subjects exhaustively, but the main points in connection with the prevention of colic will be mentioned.

Watering.

Horses require anything from 5 to 15 gallons of water a day, the quantity depending on the temperature and the amount of work performed. The water should be as pure as possible, clear in appearance, and free from taste, colour, or smell. Pure water is just as essential to a horse as it is to a man, and it is a mistake to suppose that a horse can drink badly contaminated water with impunity. Water obtained from pools or shallow wells, contaminated with surface drainage, or containing decomposing organic matter, frequently causes diarrhœa, and generally predisposes to colic. Water that contains a large amount of sediment should not be given, as the sediment causes a mechanical irritation of the mucous membrane of the stomach and intestines—*i.e.*, sand colic. When at rest in the stable, water should be given three times a day, and should invariably be given previous to feeding.

This latter point is of considerable practical importance. A horse's stomach is small in proportion to its size, and water does not remain in it, but passes through the stomach and small bowel to the caecum, or water-gut. If water is given after feeding, besides weakening the digestive juices, a considerable portion of the food in the stomach and small intestines will be washed out in an undigested state, and indigestion and colic may result. Water in small quantities can be given within an hour or so from the completion of feeding if desired. After a long journey, a good plan is to water a mile or so before the journey's end, and take the horse slowly in afterwards. This prevents chills and colic, due to the ingestion of a large quantity of water when in an exhausted state. An animal after prolonged exertion or fast work has his system depleted of fluid. He will not eat sufficiently until his thirst has been satisfied; therefore, the water should come first, and while the animal is still warm is the best time to give it. After standing, the body temperature falls, and to give cold water freely then is only to intensify the effect of the cold water on the system.

Feeding.

A consideration of the anatomy and physiology of the horse's stomach will greatly assist in understanding the digestive derangements which produce colic. The stomach is a bag-like organ with two openings, one from the gullet and the other to the bowel, and, as already stated, it is remarkably small. It has powerful muscular coats for the purpose of kneading and churning the food, and it manufactures a digestive fluid called gastric juice in very large quantities. The capacity of the organ is from 25 to 30 pints, and digestion is most rapid when two-thirds full. In respect to this latter statement, it has been found that an immoderately large feed will put back digestion for hours beyond the normal period. It is obvious that the small stomach of a horse necessitates that it must be constantly refilled in order to dispose of the large amount of food required by the animal. Food is not meant to stay long in the stomach or first portion of the intestines, and in the three or four days which it takes to go from the mouth to the anus, all but a few hours is spent in the large bowels at the end of the intestinal tract. Food should be digested and passed out quickly, and anything which causes retention of food in the stomach is liable to produce colic. To ensure rapidity of stomach digestion, it is essential that the food shall arrive in that organ in a properly prepared state. It must be thoroughly masticated and well mixed with saliva, and the better masticated the more easily is it digested in the stomach.

For perfect mastication the teeth must be in good order. Frequently in young animals mastication is imperfectly performed, due to faulty shedding of the first teeth; while in older animals, the edges of the teeth become so long and sharp that mastication becomes almost impossible. Horses so affected will bolt their food without proper crushing, and this of itself frequently causes colic through fermentation in the stomach. Teeth should

be examined occasionally, and treated if necessary, as, apart from colic, faulty teeth are responsible for great loss of condition.

If small balls of partly chewed food are found in the manger, watch the horse eating, when it will probably be found that he gives two or three rapid movements of the jaws, and drops the food from the mouth. This process is known as "quidding," and indicates that the teeth are badly in need of attention.

While on the subject of proper mastication, horses whose teeth are in good order frequently bolt their food from habit. This should be prevented by mixing chaff or dry bran with the grain, and by placing several large stones in the manger to prevent bolters from securing too big mouthfuls at a time.

Another cause of bolting is the practice of giving boiled food. This is not only unnecessary but often distinctly harmful. Boiling does not increase the digestibility of food, but permits of bolting without mastication and sudden overloading of the stomach. Further, boiled food, if not given directly it has been prepared, is apt to undergo fermentation. Linseed is the only food that requires boiling before use.

Should a horse's stomach become overloaded he cannot relieve it by vomiting, as, owing to the anatomical arrangements, vomition is impossible. To this danger must be added the further one that the pressure of food in an overloaded stomach may cause the opening into the small bowel to become closed also. When this takes place, food is imprisoned in the stomach, and after a short time will ferment, and ultimately, owing to the stretching of its walls, the stomach will become paralysed. Cases of this sort frequently occur, and rupture of the stomach is not an uncommon sequel.

The practical means of avoiding this and other stomach troubles is to give small feeds at frequent intervals, and to be especially careful with exhausted horses, mares in foal, young stock just being broken-in, and animals in poor condition. In the case of the two latter, the involuntary muscles of the bowels are in just as soft condition as the external muscular system, and are not capable of dealing with large quantities of food at a time.

Perhaps the commonest cause of colic is giving horses food to which they are not accustomed. A sound physiological reason exists for not doing this. It has been proved that the character of the food influences the quantity and quality of the gastric and pancreatic juices. A definite and constant diet produces juices capable of digesting it, but utterly incapable of dealing with sudden changes of food. Under proper conditions, no food will cause colic, although some (as for example, wheat and barley) are more indigestible than others; but many foods will do so if given in excess, or at the wrong time, such as giving lucerne to a horse that has been starved for a time. Horses can be made to exist on practically any food that is digestible, provided they are gradually accustomed to it; but to give a horse a full feed of, say, maize, if he has never had the grain before, is to invite digestive troubles that may cause death. Again, grass-fed horses suddenly put on to dry feed on being taken on a long journey, get colic, owing to the sudden change of food.

If you wish to avoid colic, give food at regular intervals, and see that the food is of good quality and of proved dietetic value. Mouldy corn, damaged oats, or musty hay very often produce colic, while proprietary foods of unknown composition and frequently of doubtful feeding value also, often do a great deal of harm. Do not give green forage in an immature, fermented, or overripe condition.

Bran mixed with maize is a favourite food, but it is much too laxative for a horse in work, and is a frequent cause of an attack of colic.

Do not give large quantities of bran to a working horse. Bran is a good food to maintain the contents of the bowels in a soft condition, and to keep them acting, especially during periods of rest; but its nutritive value is practically nil owing to all the flour being extracted from it.

Do not suddenly alter the amount of food given. It is a common practice to have horses fed up for a day or two prior to severe work, and this causes much intestinal trouble, such as stomach staggers.

Never forget that young horses cannot digest as much corn as old ones. Horses when rested, even for a day or two, should have their food, especially corn, reduced. Failure to do this is the cause of much colic.

Another common cause of repeated slight attacks of colic, especially with working horses on farms, is the dry, rough, coarse, and indigestible nature of the herbage found in many paddocks. Too much coarse food prevents digestion by reason of its irritative effect on the stomach. A certain amount of bulky fodder increases the digestibility of the more concentrated foods, such as oats, but too great a quantity of such food greatly weakens the power to digest. A good example of the results of this is seen in so-called "wild melon poisoning" The horse's stomach is not adapted for the digestion of coarse food, and any coarse food that it eats is digested in the large intestines. Farm horses, as a rule, eat far too much rough bulky fodder, and many suffer in consequence. A working farm horse does not require more than 12 lb. of hay a day, and the rest of the ration should be made up of grain, such as oats, or half oats and corn.

Watch for symptoms of indigestion, such as an offensive smell in the mouth, and the presence of undigested oats or other matters in the fæces. The condition of the skin is a good aid to detecting commencing digestive trouble; for example, the sudden swellings of nettle rash, and the irritation, and often eruption, shown by horses too highly fed. Such observation will often prevent colic, as the necessary measures (such as reducing the quantity of food given) can be adopted. A factor that cannot be overlooked in the causes contributing to colic is the way young stock are starved during periods of drought. Every farmer must realise how such periods of poverty must weaken every organ of the body, especially the digestive organs, and this weakened condition frequently results in attacks of colic when the horse is subjected to the strain of work.

Major-General F. Smith, of the Army Veterinary Department, in his work on Veterinary Physiology, makes the following statement:—"Apart from obvious explanations as errors in feeding, the most common cause of digestive

derangement is work. It is this which accounts for the majority of colic cases occurring towards the end of the day, the frequency with which the seizure occurs at or shortly after work, especially that of an exhausting nature, and the practical absence of colic among non-working horses." Every practical man knows this statement to be correct, and it is quite recognised that work interferes with normal digestion Feeding in relation to work is a big subject, but the following points should be noted: Regularity of feeding and regular, but not excessive, work, are great factors in preventing digestive diseases. Personally, I am strongly of opinion that the length of time a horse works without resting or feeding has more to do with colic induced by work than any other cause. Do not work a horse more than two or three hours at a time without giving him a short rest, especially if the work be severe, and the rest should be without harness. A few mouthfuls of water and food during these short rests is good also.

As already pointed out, horses must not be worked on a full stomach. A fall in draught, or even a bad stumble, may, on a full stomach, cause rupture of the diaphragm (midriff) or rupture of the stomach itself.

To sum up, see that a horse does not start work on a full stomach, and do not give big feeds of any sort, but more especially bulky food, during work. Small feeds on the road, and the main bulk of the food, especially hay, after work, is the best rule; but even then, do not give feed too soon after a hard day's work—wait till rest has restored the animal's digestive powers to the normal.

Of colic remedies such as can usually be obtained, I would recommend the following:—

1. *Baking Soda*—Give 2 oz. (4 tablespoonfuls) in a pint of water.
2. *Powdered Ginger*—Give 2 tablespoonfuls in a pint of warm water.
3. *Ground Black Pepper*—Give 1 tablespoonful, shaken up, in a cupful of oil.
4. *Turpentine*—Give 2 oz. (4 tablespoonfuls) in a pint of linseed oil. Shake well when drenching.
5. *Powdered Charcoal* in any quantity is useful in flatulent colic. This can be given in thin gruel.
6. *Whisky*, in half-pint doses, well diluted with water, combined with two tablespoonfuls of powdered ginger, yields good results.

Of the remedies mentioned, Nos. 1, 2, 3, 5, and 6 can be repeated, if necessary, several times at intervals of an hour. No. 4 can be repeated once after four hours' interval.

If linseed oil is not available, the turpentine can be given well shaken in a quart of milk.

Rectal injections of warm soapy water, given with a large syringe through a piece of rubber hose pipe 4 to 5 feet long, is good treatment. Six quarts should be given at a time, and repeated in an hour if required. The end of the pipe should be smooth, and it should be oiled before introducing it into the bowel. The whole length of the pipe should, if possible, be inserted, but no force must be employed to do this.

In flatulent colic, tobacco water is sometimes used as an enema with advantage. To make this, take 8 to 10 inches of twist tobacco, put into a quart of boiling water, strain, and when about the heat of freshly drawn milk, give as an enema. Mustard made into a thin paste and well rubbed on the outside of the abdomen is beneficial. Blankets, wrung out of very hot water and placed over the abdomen, with a dry blanket outside to retain the heat, are also good. It is a good plan to keep the horse walking about when violently attacked with colic, as it prevents him injuring himself when lying down and struggling.

Cultivation and Manuring of Maize Land at Bathurst.

Mr. H. S. Wark, of Bathurst, has supplied the accompanying photographs showing the results of special treatment of his maize land at White Rock. Last year Mr. Wark forwarded samples of his soils, which were analysed by Mr. F. B. Guthrie, Chemist of the Department. This portion of the area was found to be deficient in plant food, due to cropping without adequate manuring, and also deficient in humus, which lowered the water-holding power of the soil. Mr. Guthrie recommended as a preliminary treatment

Fig. 1.—Maize on Irrigated Land.

Fig. 2.—Maize on Hill Ground.

the application of 6 to 8 cwt. freshly-slaked lime per acre, followed by a dressing of vegetable matter either by harrowing in farmyard or compost manure, or by ploughing under a green crop such as cowpeas. After the preliminary treatment, the application of a good complete manure was recommended.

Mr. Wark carried out these suggestions, and found the results quite up to expectations. Figure 1 shows the crop on irrigated land, which was ploughed early in the winter, about 9 inches deep, and left lying in the rough state until the spring, when it was well cultivated with Massey-Harris cultivator, and then sown with corn-drill. One cwt. per acre of maize manure was used. After the corn came up, the land received two cultivations at intervals. One watering was given.

Figure 2 is the crop on hill ground, which received the same treatment as described with Figure 1. The corn shown in the picture is quite 10 feet in height, and the cobs are exceptionally large and regular throughout.

Farming in Cooma District.

H. ROSS, Inspector of Agriculture.

CLIMATIC conditions in the Cooma district are such that the agriculturist is confronted with difficulties, against which his more fortunate neighbours in other districts have not to contend. Frosts may happen along at almost any time of the year (this season has witnessed the extraordinary occurrence of a frost in February); and the rainfall is uncertain and sparse in some seasons. Still there is no reason to assume that this district should not develop more into an agricultural than a pastoral one. The soil in many cases is equal to some of our best soils in the State; it requires only a definite object and policy to turn its potentialities to profitable account.

It is this absence of a defined policy that has, to a great extent, hindered the progress of agricultural pursuits in the Cooma district. No systematic attempt has been made to foster and advance either the dairying industry, pig raising, potato or cereal growing. Most farmers in the past have been content to limit their cultivation operations to putting in a little rye to tide their stock over a critical period; but this half-hearted attempt is not likely to lead to that thorough understanding of the subject which the Department is anxious every farmer should possess, in order that he may receive the maximum returns from the soil and from his labour.

The chief difficulty experienced in this district is, without doubt, occasioned through the absence of suitable green winter feed. As I have mentioned before, rye is grown to some extent, but it is very doubtful if this fodder alone is the most profitable one to grow. In its green stage it is of certain value; as hay it cannot be compared with wheaten or oaten hay. The price of seed rye is 7s. 6d. per bushel; the price of fairly good seed wheat, 4s. 6d. per bushel; and I maintain that not only will crops of wheat, for either green feed or hay, prove to be more advantageous than crops of rye, but also that wheat or barley and peas mixed prove to be just as easily grown as rye. Lucerne is grown extensively; but here again, instead of it being fed to stock in its green state it is mostly compressed into hay, sold off the farm, and in many cases sold out of the district.

To make a reasonable certainty of success, it is an imperative necessity for farmers to fallow their land. In such a climate, with an uncertain rainfall, every point of moisture must be conserved in the soil. So far, not 10 per cent. of the land under cultivation is fallowed, and this is to a large extent responsible for the repeated failures experienced in this district. Artificial manuring has also not been resorted to; while seed and manure drills are almost unknown. Under those conditions it is not reasonable to expect satisfactory returns. Varieties of wheat, oats, rye, or barley are sown without reference to their suitability for this cold climate, or to their value for either green feed or hay purposes.

I would recommend for this district a total change from the methods employed hitherto, and a substitution of the following crops :—

Rye for green feed.—Black winter rye.

Wheat for hay.—Cleveland, Haynes' Blue-stem.

Wheat for green feed.—Medeah.

Oats for hay.—Algerian, Danish Island.

Fodder for ensilage—Cape barley, Skinless barley mixed with field-peas.

The seed should be sown on *fallowed land*, at the rate of 1 bushel per acre for wheat and rye, and 1½ bushel per acre for oats, with the addition of 56 lb. of superphosphate per acre. A combined seed and manure drill is indispensable.

Maize, Sorghum, Amber Cane, and Millet will do well if sown late on deeply-ploughed land. Root crops, such as Mangolds and Swedes, will, under proper cultivation, grow to perfection.

Still, any of the abovementioned crops would, under existing circumstances, not prove to be of much value to farmers, because no systematic effort is made to feed these products to the right kind of stock. To hand-feed sheep, or to endeavour to fatten cattle on cultivation areas, is mostly unprofitable, but to feed those crops to milking cows would be a step in the right direction for success.

Briefly, then, I advocate for the smaller farmer a system of dairying, pig and poultry raising.

So far, dairying has not found much favour in the Cooma district. It is hard to say why this is so, unless farmers consider the seasons too uncertain. If the natural pastures alone had to be relied on there would be good ground for their fears; but with the excellent flats at their disposal, with a better knowledge of cultivation methods, application of artificial fertilisers, and conservation of succulent feed, the would-be dairy-farmer and pig-raiser has little to fear from this admittedly erratic climate.

The improvement of natural pastures is another factor of much importance. In connection with this I would advise farmers to give a trial to Kentucky blue and Texas blue grass. The former especially is a grass suited for cold climatic conditions, and responds wonderfully well to even slight showers of rain.

To sum the matter up, I would advise farmers to keep the following points well before them :—

1. A system of fallowing cultivation areas;
2. A system of manuring;
3. Selection of the right class of seed;
4. Introduction of seed and manure drill;
5. Cultivation of summer fodders;
6. Conservation of fodder in the shape of ensilage.

By adopting the above suggestions, combined with a selection of the right class of dairy stock, I have little hesitation in saying that the Cooma district can with advantage be raised from a pastoral into an agricultural one.

FOURTH INTERNATIONAL DAIRY CONGRESS.

THE following resolutions of the Fourth International Dairy Congress, held at Budapest, 6th to 11th June, 1909, are published for general information:—

Section I.—Legislation and Regulation.

Resolved,—That this Fourth International Dairy Congress deems the superintendence of milk production, the provision of milk for the larger towns, and the trade in milk upon uniform principles of general application to be necessary.

That such principles should be settled by a properly representative International Commission of experts. The terms of reference should include the consideration of legal measures for the control of the milk.

That the section transfer to the permanent committee of the International Dairy Federation the task of considering these questions.

Resolved,—That this Congress considers it expedient that, in each cheese producing country the products should be provided with some mark guaranteeing not only purity, but also the degree of fat contents and provenience.

Resolved,—That, in view of the great part played by milk and its by-products as means of human nourishment, in the opinion of this Congress it is of the highest importance that the consumer be educated by every available means in all that relates to the composition of milk and its by-products.

Amongst the means to be employed, this Congress advises the distribution to the teaching staff of model lessons bearing upon these questions and that of practical booklets to all households, with the object of familiarising the people with these questions.

Moreover, in consideration of the great importance of milk from an economic standpoint, the Congress considers that it is necessary to promote the education of the producer by encouraging experiments in dairy-farming; increasing the number of technical agricultural and dairy schools; rendering the teaching in the institutions as perfect as possible; encouraging the teaching of dairy-farming; making known the advantages of co-operation to the producers; and organising conferences, now of agricultural associations, now of producers, &c., upon the subject of the technique of milk.

The Congress expresses the hope that the practical teaching of dairy-farming may be developed by means of the increase in the number of itinerant schools for practical teaching reorganised upon rational lines, notably by specialisation in establishments for instruction.

The Congress insists upon the necessity of laying greater stress upon the popularising of ideas germane to dairy-farming:—

1. Amongst the pupils of both sexes in rural elementary schools.
2. Amongst those of higher schools for girls in town and country.

Section II.—Hygiene and Veterinary Science.

With a view to the production of wholesome and pure milk, and having regard to the fact that market control is insufficient, this Congress emphasises the necessity of building and keeping clean stalls in some one method in keeping with general hygienic demands; the animals should be regularly (daily) led into the open air, wherever possible upon pasturage, and the place of production should be subject to sanitary and veterinary control.

1. In the work of cleaning of dairy utensils, only water previously boiled, or such as is fitted for human consumption, should be used.

2. To employ only healthy persons, and such as have no contact with contagious sick, for the treatment of milk.

3. To collect, preserve, and transport milk in receptacles perfectly closed.

4. To withdraw from the market milk produced by animals tainted with disease of such character as to render the milk harmful to the consumer.

5. To slaughter all animals attacked with tuberculosis, more especially when the udder is the seat of the disease.

6. It is desirable that only such producers whose animals have been regularly subjected to the Tuberculin test and have been passed as free from Tuberculosis, should be allowed to sell fresh milk.

This Congress expresses the desire that physiologists and chemists should make new experiments, with a view to determine exactly, or investigate the question of, the relative values, as means of nourishment, of raw, pasteurised, sterilised, and dry milk.

The Congress records its desire that the question of the influence of forage upon the composition of milk may be further studied, and that opportunity of submitting it for re-discussion be afforded by the next Congress.

The Congress demands that the production and sale of special milks of various kinds—milk for sucklings, children, &c.—may be undertaken by such persons only as have received a license from the authorities and as are placed under permanent control in a hygienic sense.

In view of the experiences gained in Denmark, this Congress considers it advisable that the practice obtaining there should be generalised in all dairy-farming countries, due regard being had to the respective local conditions.

Section III.—Industry.

The Congress desires to place upon record its opinion that the pasteurisation and use of pure cultures have hitherto produced appreciable results in the preparation of certain kinds of soft cheeses and of Parmesan, more especially when the temperature of 65° C. (149° F.) has not been exceeded, and where regard has been had to the due observance of certain hygienic precautions.

The temperature of 65° C. must not be considered as always conducing to perfect pasteurisation, since this temperature is not high enough to destroy all milk bacteria. The Congress, therefore, considers it desirable that experience and scientific investigations should follow this cause, and should be applied to such kinds of cheese as have not hitherto been submitted to thorough examination.

The Congress recognises the importance of encouraging, as far as possible, the evaluation of the by-products of dairy-farming, on account of the great influence they bear to the question of profit, more especially in regard to the preparation of butter and cheese. Skim milk in a fresh condition constitutes a wholesome and cheap nourishment, particularly for adults It may, moreover, be applied with great advantage in cookery. It is, however, desirable that the nutritive qualities of the products be made known to the poorer classes by means of cheap publications, and the introduction of the products themselves into the peoples' dispensaries and kitchens of the large towns.

It is desirable that freight charges be reduced to enable this product to be brought into general use in the large towns. The Congress recognises the hygienic necessity of heating the milk to a temperature of at least 80° C. (176° F.) before putting it upon the market.

The Congress considers it necessary to encourage the preparation of cheeses, fermented beverages, condensed milks, and milk powders extracted from skim milk, as well as the manufacture of by-products, such as Casein and Galalite.

Skim milk may be used for the nourishment, not only of calves and pigs, but also of poultry. In these cases, also, the necessity of pasteurisation remains. The fats extracted may, by means of emulsion, be replaced by foreign fats, with advantage.

The serum of cheese may be considered as a beverage, nourishment for animals, or as serving in the preparation of Caille and Casein.

Buttermilk may be usefully applied in the preparation of vinegar, lactose, milk powder, and of butter made from this milk.

The Congress recognises the influence of manure, not only upon the quantity but also upon the quality of forage, and it declares it to be necessary to pursue investigations for the purpose of bringing this question more to the front. It, therefore, begs the International Dairy Federation to place anew upon the agenda for the next Congress the question of the effect produced upon the quality of milk and products by manure and artificial manure.

Studies in Dairy Cattle Breeding

M. A. O'CALLAGHAN.

The Influence of the Sire.

"*The laws governing inheritance are quite unknown; no one can say why a peculiarity in different individuals of the same species, or in individuals of different species, is sometimes inherited and sometimes not so; why the child often reverts in certain characters to its grandfather or grandmother or other more remote ancestor; why a peculiarity is often transmitted from one sex to both sexes, or to one sex alone, more commonly but not exclusively to the like sex.*"—DARWIN.

IN the March issue of the *Agricultural Gazette*, I gave the results of the mating of pure-bred dairy bulls with pure-bred cows, mostly of a different breed to the bull. Judging by the widespread publication given to the contents of the article in question by the daily and agricultural Press, the matter dealt with has been considered of material importance to the welfare of the dairy industry, and I have received many letters from those who have given attention to the question of breeding dairy cattle, all going to show that the publication of the results has aroused a considerable amount of interest, and has developed thought along certain lines which have been proved by these experiments. As already stated, the results published so far are those obtained by using pure-bred cows as bases. As, however, the average dairy farmer's cow is a cross-bred one, experiments of any kind, to be of practical benefit to the dairy farmers, must also deal with cross-bred

Fig. 1.—Peter.

females as bases; hence that part of the experiment referred to in the summary published in the March issue as—

(*d*) To ascertain the value of the Guernsey cross on the local type of cattle of the Richmond River.

Therefore, in this issue, I give the results of the mating of pure-bred Guernsey sires with cross-bred dairy cows. As Ayrshire, Jersey, and Holstein sires have been used for some years in New South Wales for crossing purposes, there is already a great amount of available data in connection with these crosses; so the Guernsey, a breed which was new to Australia, was given a trial along similar lines.

Readers will again be able to see in this, as in the previously published results, *the wonderful and dominating influence, both in colour, form, and milk yield, of a pure-bred sire of high dairying qualities.*

First Crosses.

Bud (Figure 2).

Sire—Peter, the imported Guernsey bull.
Dam—Blossom, a cross-bred Shorthorn cow of a red colour.
Date of birth—3rd March, 1902.
Gave birth to her first calf on 23rd June, 1904.

Fig. 2.—Bud.

On her first lactation period of 342 days she gave 6,810 lb. of milk, or 424 lb. of butter.

On her second lactation period of 252 days she gave 3,362 lb. of milk, or 219 lb. of butter.

On her third lactation period of 580 days she gave 12,455 lb. of milk, or 735 lb. of butter.

On her fourth lactation period of 257 days she gave 5,685 lb. of milk, or 356 lb. of butter.

On her fifth lactation period of 282 days she gave 7,282 lb. of milk, or 429 lb. of butter.

Blossom, the dam of Bud, on her first calf gave, in 331 days, 5,271 lb. of milk, which yielded 239 lb. of butter. On her second calf she gave, in 318 days, 4,472 lb. of milk, producing 242 lb. of butter. She was then sold. There are yet no female progeny of Bud old enough to yield milk.

Bud had too long a period of lactation on her first calf, and to add to this trouble she was so difficult to dry off that she was milked practically up to date of giving birth to her second calf. Hence the very low comparative record for that period. Bud is a thick-set cow of great constitution, just the sort for a dairy farmer. She is somewhat goose-rumped, and hence is not a handsome breeder's cow; but her wedge shape, great barrel, very flat thighs, and soft skin make her nearly an ideal dairy type.

REGINA (Figure 3).

Sire—Peter, an imported Guernsey bull.

Dam—Queenie, an Illawarra Shorthorn cow of a roan colour.

Date of birth—2nd September, 1902.

She gave birth to her first calf on 22nd March, 1905.

Fig. 3.—Regina.

On first calf she gave, in 345 days, 6,750 lb. milk, or 333 lb. butter.

On second calf she gave, in 294 days, 8,005 lb. milk, or 347 lb. butter.

On third calf she gave, in 249 days, 5,324 lb. milk, or 209 lb. butter.

On fourth calf she gave, in 297 days, 6,511 lb. milk, or 306 lb. butter.

On fifth calf she gave, in 336 days, 8,235 lb. milk, or 358 lb. butter.

Unfortunately, Regina had bull calves every time save the last, and hence we have no milk records of a second cross of this family.

Queenie, the dam of Regina, was an old cow when purchased for Wollongbar Farm. Her only record there was 3,199 lb. of milk, with an average fat test of 3·2 per cent. in a short milking period of 129 days.

The photograph of this cow (Fig. 3) was taken when she was at the end of her fifth milking period, and hence she is not showing to advantage. In the group given (Fig. 4) she is seen in full milk. She is the second cow from the left.

Fig. 4.—Group of milkers, all bred at Wollongbar Experiment Farm.
Bud. Regina. Doreen. Boswe.

Dulcie (Figure 5).

Sire—Peter, an imported Guernsey bull.

Dam—Dandy, a cross-bred Shorthorn cow of red colour.

Date of birth—30th September, 1902.

She gave birth to her first calf on 3rd February, 1905, which calf was named Dulcette.

On her first lactation period she gave, in 297 days, 5,120 lb. of milk, or 234 lb. of butter.

On her second lactation period she gave, in 286 days, 5,558 lb. of milk, or 239 lb. of butter.

On her third lactation period she gave, in 250 days, 4,862 lb. of milk, or 207 lb. of butter.

On her fourth lactation period she gave, in 229 days, 4,969 lb. of milk, or 243 lb. of butter.

On her fifth lactation period she gave, in 203 days, 3,906 lb. of milk, or 182 lb. of butter.

On her sixth lactation period (unfinished) she gave, in 193 days, 5,209 lb. of milk, or 239 lb. of butter.

This cow aborted her fifth calf, hence the short milking period and poor yield on the following lactation period. She recovered, however, and gave birth to her sixth calf on 17th August, 1909. She promises to put up a big record this lactation period.

Dandy, the dam of Dulcie, gave, when about 8 years old, 4,404 lb. of milk, yielding 193 lb. of butter, in 196 days, when she aborted, and was soon afterwards sold.

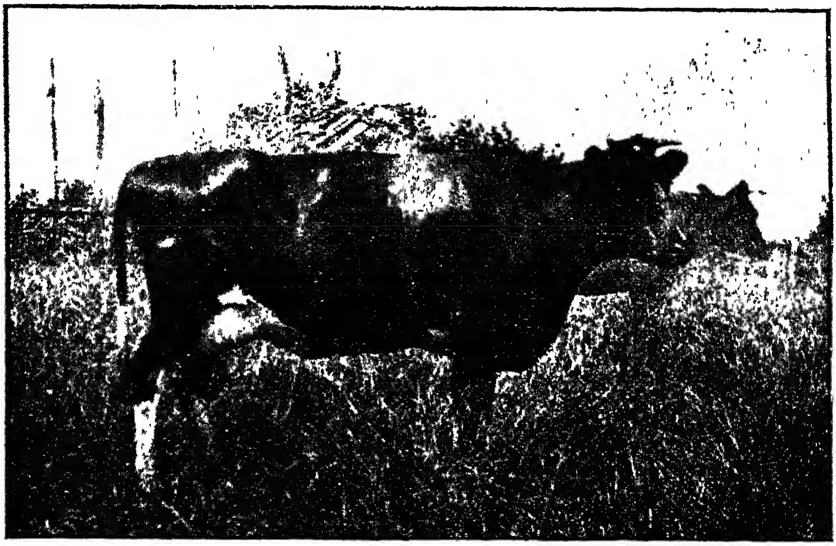


Fig. 5.—Dulcie.

NANCY (Figure 6).

Sire—Peter, an imported Guernsey bull.

Dam—Florence.

Date of birth—22nd January, 1904.

Nancy gave birth to her first calf on the 16th December, 1905.

On her first lactation period of 380 days she gave 6,953 lb. of milk, or 329 lb. of butter.

On her second lactation period of 204 days she gave 2,430 lb. of milk, or 121 lb. of butter.

On her third lactation period of 392 days she gave 7,477 lb. of milk, or 392 lb. of butter.

On her fourth lactation period of 265 days she gave 5,388 lb. of milk, or 272 lb. of butter.

There are no records available of the dam of Nancy. Her first calf was a heifer, which has been named Nan. Nancy's second calf was also a heifer, which has been named Roseleaf.

On her second calf Nancy had a bad season, when green food was scarce, in addition to which she had been milked too long on her first calf, hence her comparatively very low record that year. The records of her daughters Nan and Roseleaf will be dealt with as second crosses later on.

Fig. 6.—Nancy.

VIOLET.

Sire—Peter, an imported Guernsey.

Dam—Pansy, a cross-bred roan Shorthorn cow.

Born—18th December, 1902.

Gave birth to her first calf on 27th December, 1904.

On her first lactation period of 273 days she gave 3,911 lb. of milk, or 207 lb. of butter.

On her second lactation period of 304 days she gave 6,566 lb. of milk, or 347 lb. of butter.

On her third lactation period of 303 days she gave 7,907 lb. of milk, or 364 lb. of butter.

On her fourth lactation period of 349 days she gave 8,410 lb. of milk, or 393 lb. of butter.

On her fifth lactation period of 303 days she gave 6,108 lb. of milk, or 306 lb. of butter.

Violet has had four bull calves and one heifer, consequently there is only one second cross of this strain. Violet is in shape rather like Nancy, but somewhat more after the Shorthorn type. She has wonderfully large milk veins, a long flat thigh, incurving considerably, and has that great desideratum, a large, very bright eye.

SAPPHIRE.

Colour—Brindle.

Sire—Guernsey bull Peter (imp.).

Dam—Gem, a cross-bred Jersey.

Born—9th January, 1902.

Gave birth to her first calf on 30th August, 1904.

On her first lactation period of 300 days she gave 5,742 lb. of milk, or 317 lb. of butter.

On her second lactation period of 340 days she gave 7,038 lb. of milk, or 386 lb. of butter.

On her third lactation period of 371 days she gave 7,664 lb. of milk, or 421 lb. of butter.

On her fourth calf she aborted, and was later on sold to the butcher. There are no female progeny of this cow living.

Gem, the dam of Sapphire, when about 9 years old, gave 9,686 lb. of milk in 337 days, but on her next calf she gave only 4,557 lb. of milk in a period of 203 days. She gave birth to but one heifer calf while used for experimental work.

Fig. 7.—Peter's Lad, by Peter (imp.), from Souvenir (imp.).

Fig. 8.—Duchess, by Rose Prince (imp.).

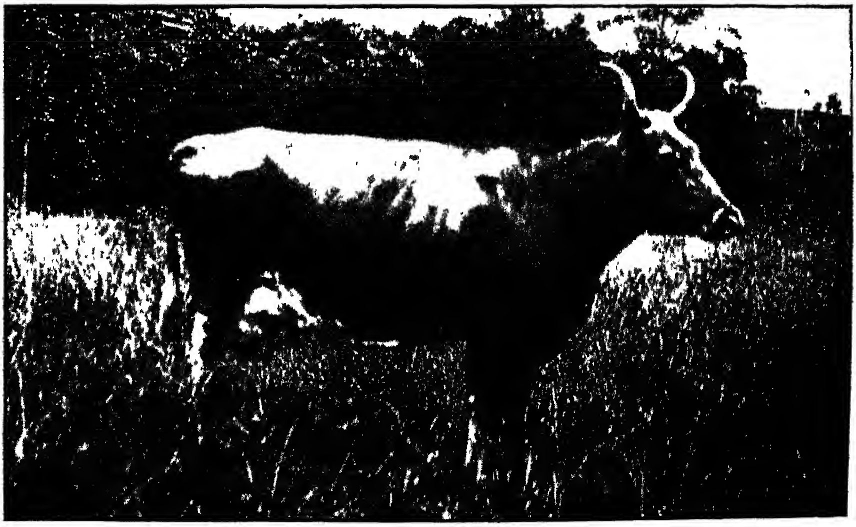


Fig. 9.—Sovereign, by Rose Prince (imp.).

Coral.

Colour—Lemon and white.

Sire—Peter, an imported Guernsey.

Dam—Ruby, a cross-bred Shorthorn.

Born—3rd February, 1902.

Gave birth to her first calf on 20th November, 1903.

On her first lactation period of 345 days she gave 3,861 lb. of milk, or 204 lb. of butter.

On her second lactation period of 304 days she gave 4,503 lb. of milk, or 243 lb. of butter.

On her third lactation period of 457 days she gave 6,393 lb. of milk, or 335 lb. of butter.

On her fourth lactation period of 299 days she gave 4,100 lb. of milk, or 217 lb. of butter.

This last yield was given during a bad season.

This cow had five bull calves, and was then sold. She was allowed to go to the bull too early, as she was but 1 year 9½ months when she gave birth to her first calf.

Ruby, the dam of Coral, gave 6,810 lb. of milk, which yielded 287 lb. of butter, in a milking period of 321 days.

Caper.

Colour—Yellow.

Sire—Peter (imp.).

Dam—Kate, a cross-bred Shorthorn.

Born—30th April, 1902.

Gave birth to her first calf on 21st February, 1906.

On her first lactation period of 343 days she gave 6,794 lb. of milk, or 399 lb. of butter.

On her second lactation period of 358 days she gave 4,672 lb. of milk, or 267 lb. of butter.

Caper gave birth to two bull calves, then aborted, was fattened, and sold to the butcher. On her second calf she gave a poor yield compared to her first; but besides no doubt suffering from the effects of a long milking period on her first calf, she met a very dry, bad season for milk on her second calf.

All the above cows are by the imported Guernsey bull Peter, already referred to in the March issue of the *Agricultural Gazette,* and another photograph of which is produced in this issue. I have given the results in this issue, not of selected progeny of this bull, but actually of all the females got by him at Wollongbar from grade cows.

It will be evident, especially to those readers who have read the results of the crossing experiments which appeared in the March *Gazette*, that the bull, when properly selected and bred, dominates to an almost incredible

extent the milk yields of his progeny. Of course it cannot be claimed, nor should any attempt be made to do so, that every pure-bred Guernsey bull that was well descended would have got as striking results as the bull above referred to. His prepotency was very remarkable, and not only has he conveyed milking characteristics to his progeny, but he has also conveyed this trait to his pure-bred sons, one of which is the bull illustrated herewith (Fig. 7), namely, Peter's Lad, for which Sir Thomas Ewing paid the Department of Agriculture 100 guineas. This son of Peter is getting very fine milking stock, and no doubt the line of milking is being carried on the male side through this young bull. Whether Peter will have the power to convey to the male progeny of his daughters the ability to transmit great milking characteristics to *their* progeny it is impossible to say. As that great naturalist, Darwin, has said, in the extract given above, "a peculiarity is often transmitted from one sex to both sexes, or to one sex alone, more commonly, but not exclusively, to the like sex." We have, however, some young bulls bred from a daughter of Peter, and we shall soon be able to have female progeny from them in milk.

Students of breeding are aware of the number of difficulties which lie in the path of those experimenting in cattle breeding along certain lines, and it will be noted by readers that the great majority of the progeny of the first cross of our Guernseys have been bulls, and hence the unavoidable delay in obtaining a sufficient amount of data from second crosses. I hope, however, to be able to publish some records very soon, which will throw some light on the advisability or otherwise of following on the second cross of the Guernsey. Our available data on second crosses, obtainable at Wollongbar Experiment Farm, is very small, as readers will be able to see; but in the large grade herd of Sir Thomas Ewing, who has been using the Guernsey bulls for some years now, there are a number of second, and even third, crosses; and, whereas no definite records have been kept, he states that the second cross, and even the third cross, so far as they have been obtained, are very satisfactory.

A Tweed River Grade Guernsey Herd.

Unfortunately for our purposes, Sir Thomas Ewing does not keep full records of the individual cows in his herd. He tests each cow both for quantity and for butter-fat now and again, during her milking periods, and if she satisfies his ideas of a standard she is kept in the herd; if not up to the standard, she is sold.

Sir Thomas Ewing was one of the first to appreciate the possibilities of the Guernsey for crossing purposes, and after he had seen some of the results produced at Wollongbar Farm, he endeavoured to procure some grade Guernseys where possible. In the Berry district he obtained a few that were by Rose Prince (imp.), from the original cross-bred Ayrshire Shorthorn cows of the district. These he mated with other pure-bred Guernsey bulls, and the results of the second crosses, he informs me, are highly satisfactory. In almost every case, he states, the daughters are better than their dams.

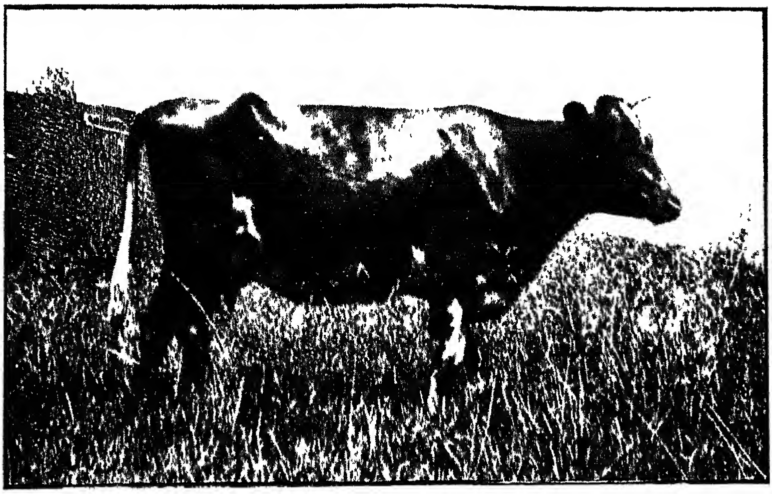


Fig. 10.—Princess, by Rose Prince (imp.).

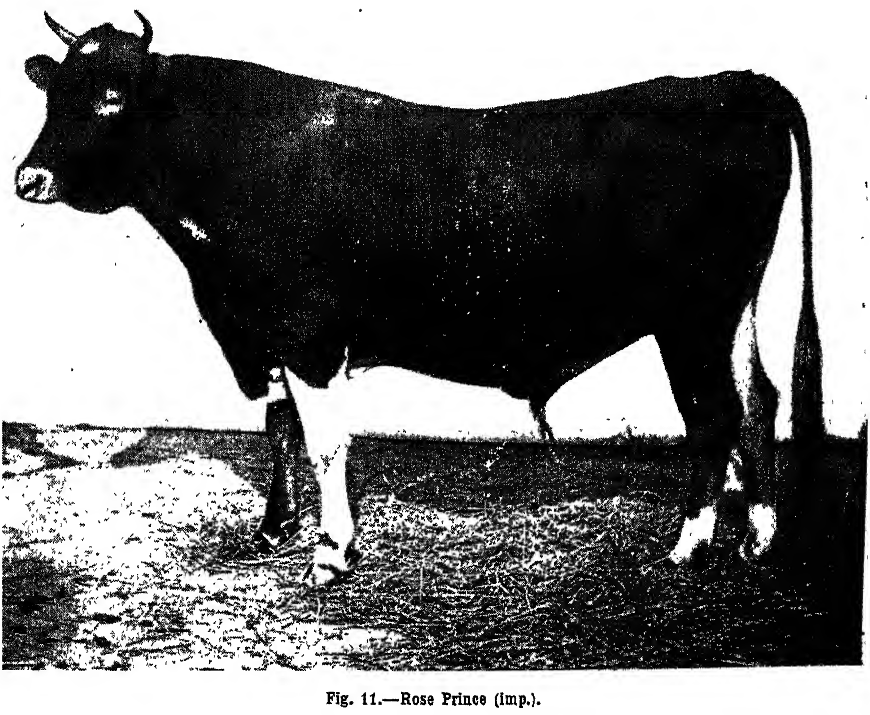


Fig. 11.—Rose Prince (imp.).

The following are the particulars of three first crosses by Rose Prince, illustrated in this issue:—

Duchess (Figure 8).

This is a mature cow by the Guernsey bull Rose Prince (imp.), from an Illawarra Shorthorn cow. She is a big yellow cow, with a little white, and has all the appearance of a strong constitution and a good dairy cow, which the man in charge of the herd has informed me she is. She was bred by Mr. H. I. Lovegrove, at Berry.

Sovereign (Figure 9)..

This is another mature cow, bred on nearly similar lines of blood to Duchess. She is a very strongly constituted cow, and a good milker and breeder. Like Duchess, she was bred on the South Coast, at Berry, and is from an Illawarra Shorthorn cow.

Princess (Figure 10).

This is also a daughter of Rose Prince (imp.), from an Illawarra Shorthorn cow. Though not so handsome as Sovereign, she is a good dairy cow. She was nearly dry when this photograph was taken, and hence is not seen at her best.

Rose Prince (imp.) is a pure-bred Guernsey bull, and is a great sire of bulls. There are not many pure-bred cows by him, but he has got a couple of very handsome ones at Berry Stud Farm. Though he was more fancied than Peter when both arrived from England, it is doubtful if he was as good a dairy sire. He had not, however, the same opportunities with cross-bred cows as Peter, and hence we have fewer records from his progeny.

Before going further with this series of articles, I must thank the late manager of Wollongbar Farm, Mr. Gorman, and the present manager, Mr. Alexander, for keeping the records which I have been able to publish, and also Sir Thomas Ewing for affording me facilities in making observations on his grade herd Guernseys.

Flower Garden and Pleasure Grounds for Country Homes.

H. REID, Gardener, Hawkesbury Agricultural College.

By a "flower garden" we understand that a section of ground is expressly allotted to the cultivation of flowers. In the "pleasure ground" we expect to find lawns, trees, and shrubs. Flowers of certain kinds may be appropriately introduced, yet they need not constitute the principal feature, as they should do in the flower garden. At the present day the flower garden is looked upon as indispensable to every residence, from the mansion to the unpretending villa or farm house.

The Flower Garden.

Although in this country the flower garden may be said to have come into existence within the last forty years, it has, during that time, gone through several phases. The more simple arrangements and combinations of the earlier attempts were succeeded by the period of hard straight lines and violent contrasts. These in turn gave place to the present system, where plants possessing noble form and graceful foliage are arranged in combination with others of more subdued colours than were in vogue in years past.

There are yet those who condemn modern flower gardening in its entirety, designating it as unnatural in every way, but forgetting that the same might be said with more or less truth respecting the treatment and arrangement of almost every plant we cultivate. To those who see nothing to admire in vegetable life except where it exists in the wild grandeur of the primeval forest, a garden of any kind can have but slender charms. There are others who are so enamoured with the fashion of modern gardening that they establish it in the most inappropriate situations, where its effect on the surroundings is such as to mar the whole scene. Here, as in most other matters, the course directed by extreme views is not the best to follow.

In this country the aspirations of the majority are associated with the home, and the embellishment of that home by combining with it the most beautiful flowers and plants, and by tastefully grouping or contrasting the finest forms of leaf growth with the most striking beauty of colouring. There is no system of arrangement that gives such scope for the realisation of these feelings and conceptions as the modern flower garden.

Before proceeding further it may be well to note a few of the mistakes as to position, construction, and the choice of plants which have done much to bring discredit on this style of gardening. In the first place a flower garden, in common with everything else, may be a thing of beauty in itself and still be so far out of character in the situation in which it has been placed as to

injure the effect of something of far greater importance. This is an error which we see exemplified in many places where the flower garden has been placed in the most prominent position, adjacent to the windows of the house and occupying the foreground of an extended view. In such case it frequently forms a blot in the picture, offensive to the eye gifted with taste and judgment in regard to landscape effect. Where the windows of a house command an open view of park land of moderate extent, it is a glaring mistake to introduce colour in ever so slight a degree between the eye and the distant prospect. There are indeed few places in which the desire for a flower garden cannot be gratified without placing it in a spot where this objection will apply; for there generally exists, or may be found, a suitable site, more or less confined, without interfering with anything else, and where it can be fully enjoyed. In places of moderate extent, where even from the best point of view there may exist something in the distance that is objectionable and from which it is desirable to divert the eye, the introduction of a flower garden, instead of being out of place, is the best means possible of effecting the desired end.

Extent.

This is a very important consideration, not only as affecting the flower garden itself but in every other respect. Consideration must be given to the labour available, and the other resources of the place, which should be adequate to cope with the yearly propagation and continuous attention required by the plants employed. The necessity for this has of late years been much increased by the introduction of spring bedding. Certainly spring bedders are indispensable if the full measure of floral effect is to be produced through the cycle of the year. They are especially attractive in the early months before the summer bedders can be planted out; in fact the spring occupants of the beds are looked upon by many persons with much more favour than their summer followers.

The labour attending gardening has also been much increased by the very effective system of carpet bedding which has come so much into fashion of late years; and there is every likelihood of its continuance, the blending colours producing very fine effects. It therefore behoves anyone who contemplates the formation of a flower garden to consider well the available labour and the means for propagation of the plants required. A small place well managed is immensely preferable to double the area indifferently looked after.

The site chosen, it becomes a consideration how to dispose of the space available. Nothing is more common than to see a piece of ground, square or otherwise, enclosed by a wall, a hedge, or a formal bank of shrubs, in which far the greater portion of the surface is occupied by the beds. Such an arrangement has much the effect of a large highly coloured picture without background, placed in a scanty frame. Now if the space occupied by the beds had been confined principally to the centre of the area, and had not covered more than a third or a fourth of the whole, the remainder in grass to

serve as a background, the effect would have been immeasurably better, and that at one-fourth the cost for labour and material.

Straight, unbroken terraces, on which run straight walks, and by the margin of which are placed formal shrubs, the whole enclosing a space bounded by straight lines, look stiff and unsightly.

Where gravel is used to divide the beds an edging of some sort becomes a necessity, in order to keep up the soil. For this purpose box edging looks much the best and is most appropriate, but a flower garden cut out of grass looks infinitely better than any arrangement that requires a permanent edging to the beds.

Aspect.

An easterly or north-easterly aspect is the best. It is of little use trying to lay out a flower garden in an exposed position where there is nothing to check the westerly and north-westerly winds. These are harmful to the sub-tropical plants now so largely employed, and which are more or less indispensable to break the otherwise monotonous and too even surface. They must have considerable shelter or their leaves become so disfigured as to render them unsightly instead of being objects of beauty.

Preparation of the Ground, Drainage, &c.

The measure of success to be attained in flower gardening depends a good deal upon the nature of the land. Heavy, retentive soils, even with the assistance of thorough drainage, will not answer, for several reasons. The nature of garden plants is such as to require a soil that is warm and early, so that they may, after planting out, grow rapidly and in the least possible time fill their allotted space. Where this does not take place their season of beauty is shortened and the autumn frosts are upon them by the time they get into their best garb. Again, the majority of the plants are fine-rooted and make greater progress in a soil that pulverises readily and offers little resistance to the penetration of the young feeding roots. In heavy ground these conditions are altogether wanting. Consequently the natural soil must be removed from each bed and a light or sandy loam added to reduce the whole to a proper consistency. It would be still better if the whole surface of the garden were so treated, both the space occupied by the beds and that which is between them, for this reason, that if at any time the design has to be altered and the beds occupy different positions, no further excavations or additions would be required after the first formation. This does away with a serious difficulty in the matter of drainage, for where the natural soil has been replaced by a lighter and more porous one in the space occupied by the beds only, each bed acts as a receptacle for the water that naturally drains into it from the surrounding ground, and drainage becomes an absolute necessity. To assist drainage when the land is very wet and retentive, a layer of rubbish, rubble, or other rough material should be put in the bottom of each bed.

But under any circumstances drainage is an advantage, as the mere mention of some of its effects is sufficient to show. Drainage not only removes the

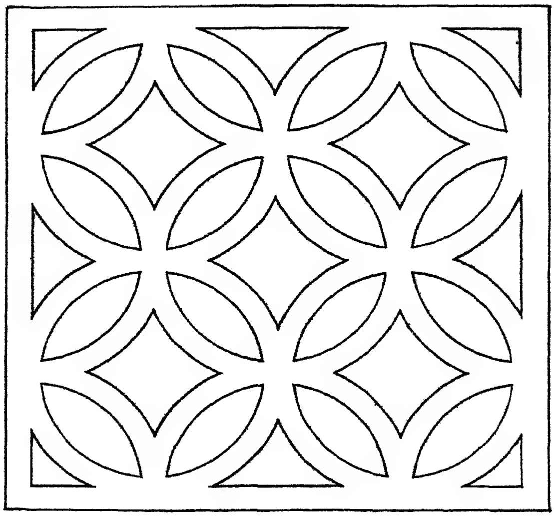


FIG. I.

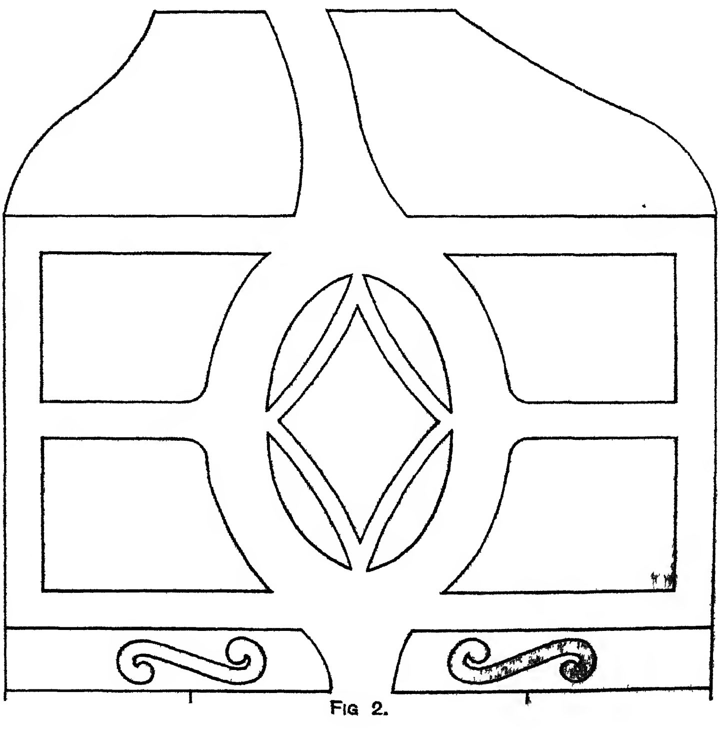


FIG 2.

PLATE I.—DESIGNS FOR FLOWER GARDENS.

excess moisture, but also draws fresh supplies of air into the soil, which tend to keep it sweet. Yet, perhaps, the most important effect is that it keeps the soil warmer, the temperature of a well-drained soil being several degrees higher than that of surrounding undrained ground. This more than anything aids rapid growth and development.

A little consideration will convince anyone that not only do different soils require different treatment as regards drainage, but that the plants intended to be grown also deserve attention. Take, for example, a strong, retentive soil. In this, especially if of considerable depth, the drains should be placed not more than 9 to 10 feet apart, and in all cases must be of sufficient depth to go 8 to 10 inches into the subsoil, if that is composed of clay or other retentive material. If the pipes are not thus laid below the pan, through which the surface water cannot percolate, it will be evident that the results will only be partial. Neither is the ordinary construction of drains, consisting of a simple pipe, alone sufficient. Instead of filling in the earth on top of the pipes in the ordinary way, there should be placed over them a layer of broken brick, stone, rubble, or turf or whatever material is most convenient in the neighbourhood. This should be placed over the pipes in sufficient thickness to come within 15 inches of the surface. Even those who are not conversant with the subject will at once perceive that drains so constructed must be quicker in their action and more efficient than such as are made with ordinary pipes alone. Where the soil is lighter in nature and the natural sub-drainage is better, less care need be exercised in covering the drain pipes, nor need they be placed so close together.

For sub-tropical bedding, such as is now deservedly so much in favour, it is not only found necessary for many plants that the land be thoroughly drained in the ordinary sense, but the whole undersurface of the beds should be so constructed as to form a continuous drain by which the water may be carried away as through a sieve. The material also acts as a duct by which the sun-warmed air may enter and impart heat to the soil above it. By this means many plants can be induced to flourish through the season, except where there is frost in the winter months. For sub-tropical plants the soil should be light and porous in nature, consisting largely of decomposed vegetable matter, such as rotten leaves—a soil of fibrous turfy loam with sufficient sand to keep the whole sweet and porous. For bedding plants in general the soil should not be less than 15 inches in depth except for strong-growing subjects. A couple of inches of manure in the bottom will be an advantage to assist the plants through dry weather.

Water.

There is one great deficiency in many gardens, and that is an adequate supply of water with sufficient head to be available without hand pumping. There is, indeed, less provision made for this in Australia than in any other part of the Empire. In no department is this more felt than in the flower garden, where, owing to the surface-rooting nature and quick growth of

many of the plants, it is much required, and where to supply it in driblets, as must necessarily be the case when it has to be carried by hand or conveyed in the ordinary water cart, is worse than useless. Every flower garden of any pretensions should be furnished, according to its dimensions, with a certain number of standpipes, connected with a sufficient head of water to provide an unlimited supply in dry weather. These standpipes should be so arranged that by the attachment of a hose all parts of the beds can be soaked as they require it. Nothing is more painful to look upon than a garden in which the plants are shrivelling in the sun instead of showing the health and vigour they display when given sufficient moisture; this also at a time when their beauties are most appreciated. There are few gardens where water could not be made available by means of a hydraulic ram, a water wheel, or a small engine, at a point sufficiently high to give a head that would do away with the ordinary hand application, which belongs to the past age of waggons, &c., and which, viewed in its true light, is the greatest combination of extravagance and inefficiency that could be imagined. In hundreds of gardens where water is now deficient there are streams at hand down which millions of gallons run yearly to waste, which, at comparatively little cost of piping to intercept and convey it through mechanical contrivances, could be made available. Where there exists a stream, even considerably below the garden level, sufficiently large, and to be depended on for a supply in dry seasons, a pump driven by a water wheel would be the least expensive means to adopt, but in that case it would be necessary that the supply be plentiful, as the quantity of water required to run the wheel, and which of course escapes, is considerable. The hydraulic ram comes next in the scale of costs. With much less waste of water, it can be used where the supply is more limited. Given a stream with a small continuous flow, a ram will, by its incessant action, throw a considerable quantity of water. If either of these appliances are adopted it will be necessary to provide sufficient storage room in the shape of large tanks, but where there exists a supply at such an elevation that it can be conveyed by gravitation through a simple pipe to the point required, the cost of obtaining it is very small. Where this necessary provision of water is made for the flower garden, the pipes should be laid as soon as the land is drained and before the work proceeds further. They should be placed deep enough to be out of reach of the spade or frosts, and can be so arranged as not in any way to prove unsightly; indeed it is not necessary that the tops of the standpipes should in any case be more than a few inches above the ground-level. The taps should be fitted with screws to which the hose can be attached, and should be placed at moderate distances apart so as not to require long lengths of hose, which are not only a disadvantage but are also costly.

Style.

The site being selected and the preliminary preparation of the ground completed, the next matter to be considered is the style to be adopted in

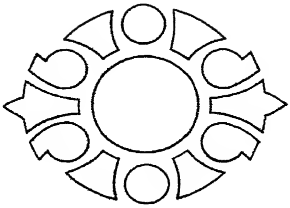


FIG. 3.

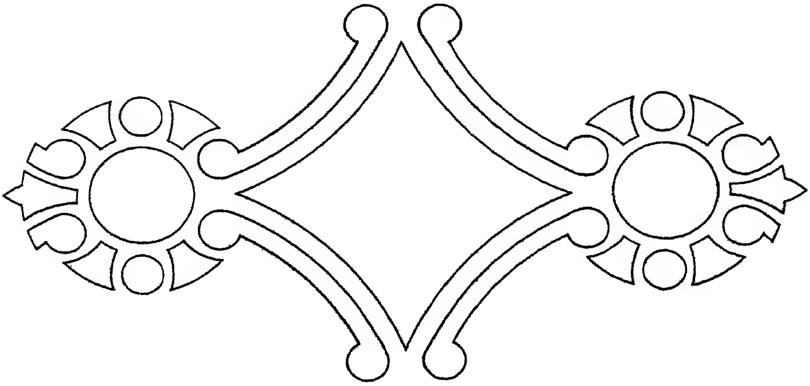


FIG. 4.

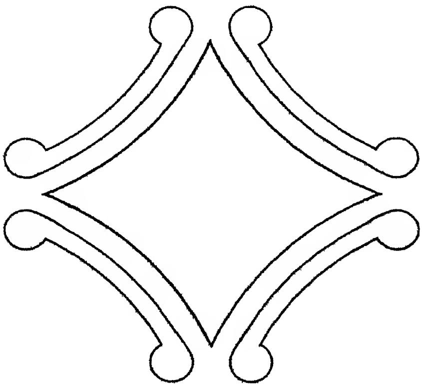


FIG. 5.

PLATE II.—DESIGNS FOR FLOWER GARDENS.

the laying out of the garden. In this there is considerable latitude, the principal guiding points being the position and surroundings, such as the character and size of the house, especially the latter. A garden so small as to be out of proportion to a large stately building to which it stands in close proximity, would be quite inappropriate; but not so much so as when, in the other extreme more commonly met with, the garden covers a larger area than the size of the residence would warrant. In this there is, of course, no fixed rule by which to be guided, but the garden should be subordinate to the size of the building of which it is an embellishment, always bearing in mind that it is better to underdo than overdo the extent of this kind of decoration.

The different designs generally employed may be classed under three heads—the picturesque, the geometrical, and the symmetrical. The last-named is more or less free in its arrangement and, as the term implies, is essentially irregular and an attempt to imitate nature. Many have tried to work out this class of flower garden, but generally with very indifferent success. The geometrical style, sometimes designated the architectural or ancient, is that which is most generally employed, since it admits of almost every conceivable form of the parts and the whole. With a sheet of paper, a pencil, a rule, and a compass, the arrangements may be varied indefinitely. This design, pure and simple, is essentially formal and well calculated to illustrate certain objects, such as a perfectly even balance of form and colour, the corresponding beds in the design being exactly alike in shape and size and filled with plants that match in every way. Figure 1 is an example of the geometrical style. It is formed by the intersections of five circles, four semicircles, and four quadrants within a square, and thus the shape of the twenty-nine beds, of which the figure is composed, are determined.

A very neat and pleasing geometrical design, which may be applied on a larger or smaller scale, is shown in Figure 4. Such a group might be cut on grass at the side of the house. This group can be separated into two designs as shown in Figures 3 and 5, taking the centre by itself as one, and the end as another.

Figure 2 is also very neat and very plain. Simple figures, when well planted, always have the best effect. This design would suit well for a school garden, or a farm, for this reason: The centre could be planted with roses, carnations, or any dwarf flowers; the back of the beds on the right and left of the avenue could be planted with ornamental shrubs and small ornamental trees, leaving from 6 to 8 feet for flowers in the front, commencing with dwarf flowers and gradually rising with taller growing plants to the shrubs and ornamental trees. This arrangement gives good shelter and makes a good background. If the design is used for a school garden, only flowers, shrubs, and ornamental trees should be planted in the design proper, the cereals and vegetables being placed on the outside of the beds altogether so as to avoid the mixing which so often occurs.

Planting.

This is a matter that must be left to individual taste. There is, however, no question that violent contrasts are objectionable and not nearly so pleasing as gradual blendings of colour. Preponderance should be given to such as are of subdued character. Then, again, the highest colours used should occupy the outer edges of the garden, inasmuch as these, wherever they are, attract the eye, and thus, if they occupy the centre of the design, have the effect of apparently diminishing the size of the garden. As to the height of the plants which form the principal furnishing of the garden, they should never be so high as to obstruct the view of those in the adjoining beds, especially as seen from the principal point of sight.

Whatever the arrangement adopted for the summer season, it can only be satisfactory for that period, leaving the garden blank for the greater portion of the year, unless recourse is had to the indispensable winter and spring bedders. These give desired continuity to the whole, and cannot be too much encouraged. But here again discrimination is required in the selection of plants in every way suitable for the purpose. In addition to bulbs, such as hyacinths, tulips, daffodils, narcissi, jonquils, anemones, ranunculi, there are also a great many bedders—for instance, pansies, phlox drummondi, stocks, salpiglossis, gaillardias, carnations, sweet peas, poppies, and asters—which bloom better in the winter and spring months than during the hot summer.

Reserve Garden.

In every place where flower gardening is attempted to be carried out to anything approaching the requirements of the present day, the reserve garden, in which the winter and spring bedders can be prepared, is an adjunct that cannot well be dispensed with. It should be in a spot somewhat sheltered from northerly and north-westerly winds, but one which is not so confined as to make the plants in any way delicate. The soil should not be too rich, or it will have a similar effect, but should be light in texture so that the plants can be taken up with their roots entire and with a good ball of earth; for on this depends much of their ability to fulfil the object for which they are intended, namely, to yield an immediate effect.

Seeds should be sown in February and March for spring flowers, which are planted out in April and May. Summer flowers are sown in August and planted out in September and October. It is always better to prepare a bed in a sheltered spot for seeds alone, so that the young plants will not be destroyed by frosts or hot winds when they are coming up.

Preparing Compost.

To prepare compost for seed beds, and also for potting plants, lift old fibrous rooted turf, about 2 inches thick, from an old grass paddock, place it in a heap, grass side down, and let it decay; chop it up fine with a spade as you require it, and mix with some decayed leaves and sand so as to make it light and open. When sowing seeds, care should be taken not to cover them too deeply.

(*To be continued.*)

Book-keeping for Farmers.

[Continued from page 422.]

P. G. GILDER, English Master, Hawkesbury Agricultural College.

The Ledger.

THIS, in itself, is the most important of the books of reference, as it contains an abstract of every transaction recorded in business. It is ruled with columns for "Date," "Name of corresponding Cr. entry," "Journal folio" and "Amount" on the Dr. side, and a similar number of columns on the Cr. side.

Dr.						Cr.					
Date.	Name of corresponding Cr. entry.	Journal folio.	£	s.	d.	Date.	Name of corresponding Dr entry.	Journal folio.	£	s	d.

Every account mentioned in the Journal requires a Ledger account under its own heading. In actual practice, these would appear on various pages, allocating say ten to the bank, twenty to stock, ten to horse, and so on, according to the number of likely transactions. An index is required, and it is desirable to classify them as already stated.

In the following, the accounts only are numbered, and dates and Journal folio columns are omitted to facilitate working:—

1. CAPITAL.

To Balance	*1,150*	*0*	*0*	By Bank	1,000	0	0
				„ Interest	50	0	0
				„ *Profit & Loss a/c.* ...	*100*	*0*	*0*
	£1,150	*0*	*0*		*£1,150*	0	0

2. BANK.

To Capital	1,000	0	0	By Horse	150	0	0
„ Crops	100	0	0	„ Stock	400	0	0
„ Dairy	10	0	0	„ Wages	120	0	0
				„ Rent	80	0	0
				„ *Balance*	*360*	*0*	*0*
	£1,110	*0*	*0*		*£1,110*	0	0

3. HORSE.

To Bank	150	0	0	*By Balance (Valuation)*	*140*	*0*	*0*
				„ *Profit & Loss a/c* ...	*10*	*0*	*0*
	£150	*0*	*0*		*£150*	*0*	*0*

4. STOCK.

	£	s.	d.		£	s.	d.
To Bank	400	0	0	By James	300	0	0
" *Profit & Loss a/c* ...	*200*	*0*	*0*	" *Balance (Valuation)*	*300*	*0*	*0*
	£600	*0*	*0*		*£600*	*0*	*0*

5. PLANT.

	£	s.	d.		£	s.	d.
To Sydney Plough Co.	50	0	0	*By Balance (Valuation)*	*40*	*0*	*0*
				" *Profit & Loss a/c* ...	*10*	*0*	*0*
	£50	*0*	*0*		*£50*	*0*	*0*

6. CROPS.

	£	s.	d.		£	s.	d.
To Profit & Loss a/c ...	*160*	*0*	*0*	By Bank	100	0	0
				" *Balance (Valuation)*	*60*	*0*	*0*
	£160	*0*	*0*		*£160*	*0*	*0*

7. DAIRY.

	£	s.	d.		£	s.	d.
To Profit & Loss a/c ...	*10*	*0*	*0*	By Bank	10	0	0
	£10	*0*	*0*		*£10*	*0*	*0*

8. JAMES.

	£	s.	d.		£	s.	d.
To Stock	300	0	0	*By Balance*	*300*	*0*	*0*
	£300	*0*	*0*		*£300*	*0*	*0*

9. SYDNEY PLOUGH CO.

	£	s.	d.		£	s.	d.
To Balance	*50*	*0*	*0*	By Plant	50	0	0
	£50	*0*	*0*		*£50*	*0*	*0*

10. WAGES.

	£	s.	d.		£	s.	d.
To Bank	120	0	0	*By Profit & Loss a/c* ...	*120*	*0*	*0*
	£120	*0*	*0*		*£120*	*0*	*0*

11. RENT.

	£	s.	d.		£	s.	d.
To Bank	80	0	0	*By Profit & Loss a/c* ...	*80*	*0*	*0*
	£80	*0*	*0*		*£80*	*0*	*0*

12. INTEREST.

	£	s.	d.		£	s.	d.
To Capital	50	0	0	*By Profit & Loss a/c* ...	*50*	*0*	*0*
	£50	*0*	*0*		*£50*	*0*	*0*

Neglecting the entries in *italics*, which will be explained later, it is now possible to verify the correctness of the posting (*i.e.*, entering into the Ledger) by means of a trial balance. The totals of each side of every account are added, and the results should be equal to the totals of the Journal, and, of course, to one another.

TRIAL BALANCE.

Dr. £	s.	d.	Name of Account.	Cr. £	s.	d.
....			Capital	1,050	0	0
1,110	0	0	Bank	750	0	0
150	0	0	Horse	....		
400	0	0	Stock	300	0	0
50	0	0	Plant	....		
....			Crops	100	0	0
....			Dairy	10	0	0
300	0	0	James...	....		
....			Sydney Plough Co.	50	0	0
120	0	0	Wages	.. ..		
80	0	0	Rent	. ...		
50	0	0	Interest	. .. .		
£2,260	0	0		£2,260	0	0

It does not necessarily follow that, the Dr. and Cr. columns being equal, the postings must be correct, inasmuch as it does not disclose when there is an entry on the right side, but posted to the wrong account, or a posting to the wrong side, with its corresponding entry also on the wrong side.

The making up of a trial balance has so many distinct advantages, that it must never be dispensed with. Any error must be at once looked for, because, if allowed to remain, the balancing entry will also be wrong, and it will be practically impossible to compile a correct balance-sheet and profit and loss account. It is convenient to remember that if one side is deficient by the same amount as the other side is in excess of the Journal total, an entry of that amount has usually been posted to the wrong side.

The trial balance is of great assistance in detecting mistakes in posting, such as taking 6 for 0, 7 for 1, 3 for 5, and *vice versâ.* Another common error is to place the figures in the wrong money column, making 5s. 7d. appear as £5 7s.

In actual practice the Journal is not totalled, and the trial balance is made up by stating only the differences between the various accounts. This would then appear as follows, and the method can be recommended when a fair amount of proficiency has been gained.

TRIAL BALANCE BY DIFFERENCE.

Dr. £	s.	d.		Cr. £	s.	d.
....			Capital	1,050	0	0
360	0	0	Bank	....		
150	0	0	Horse	....		
100	0	0	Stock	....		
50	0	0	Plant	... .. .		
....			Crops	100	0	0
....			Dairy	10	0	0
300	0	0	James...	....		
....			Sydney Plough Co.	50	0	0
120	0	0	Wages	. .. .		
80	0	0	Rent	. ...		
50	0	0	Interest	....		
£1,210	0	0		£1,210	0	0

In the above example, very little time is saved, owing to its extreme simplicity, but where numerous accounts, many of which have been balanced off, are concerned, the economy in labour is considerable.

From the trial balance we can without difficulty make up our balance-sheet, provided an estimate has been made of the value of the stock, plant, &c., on hand.

The balance-sheet from the above trial balance will appear as follows:—

BALANCE-SHEET.

Dr. (*or Liabilities*).	£	s.	d.	*Cr.* (*or Assets*).	£	s.	d.
To Sydney Plough Co. ...	50	0	0	By Horse (as per valuation)	140	0	0
" Capital	1,050	0	0	" Stock " ...	300	0	0
" Difference, being profit ...	100	0	0	" Plant " ...	40	0	0
				" Crops " ...	60	0	0
				" Bank (as per Ledger) ...	360	0	0
				" James (book debt) ...	300	0	0
	£1,200	0	0		£1,200	0	0

If the assets are worth less than the liabilities, a loss has been incurred, and the capital diminished by that amount.

It will be noticed that the actual return has been £50 for the use of the £1,000 capital and £100 as a general profit.

Though this method indicates the total increase or decrease in capital, it does not disclose how the profit or loss has been made. In order to do this, each account will have to be properly balanced.

Leaving the Capital Account, we find from our trial balance that £1,110 has been received by the Bank Account, and £750 paid out, leaving a Cr. balance of £360. This is inserted, both sides totalled and ruled off, as seen from the entries in *italics*.

In the Horse Account, the valuation £140, or our estimate of what they are worth at the end of the year, is entered as a Cr. balance, and the difference between their original price and present value (£10) is carried to a Profit and Loss Account, as being the cost of using the horses throughout the year.

The Stock Account shows that £400 was paid for them. £300 worth has been sold, and £300 worth remains on hand; consequently a profit of £200 has been made, and to balance the account this is debited.

The other entries are treated in similar fashion, all cash, stock, crops, &c., on hand, and all amounts owing to or by the owner being carried to a Balance Account, and any differences to a Profit and Loss Account. In the case of wages, rent, and interest, it is clearly seen that they are losses in themselves, although contributing to the net gain. The Profit and Loss Account thus stands as under, the items being transferred to the side opposite to that on which they appear in the ordinary Ledger account (thus adhering

to the essential principle of double entry, that every debit must have a corresponding credit):—

PROFIT AND LOSS ACCOUNT.

Dr. (Losses).	£	s.	d.	Cr. (Gains).	£	s.	d.
To Horse	10	0	0	By Stock	200	0	0
,, Plant	10	0	0	,, Crops	160	0	0
,, Wages	120	0	0	,, Dairy...	10	0	0
,, Rent	80	0	0				
,, Interest	50	0	0				
,, Capital a/c (net gain)	100	0	0				
	£370	0	0		£370	0	0

It will be noticed that this carries out the second important rule referred to—"Debit losses; credit gains."

The Americans, following the order in which these items appear, are slightly more accurate, and usually call this a loss and profit account.

The way in which the profits have been made is thus disclosed. If the horse-hire, wages, rent, &c., were charged to the crops, and the book-keeping carried out in further detail, the statement would have a different aspect, though the result would be the same.

This difference of £100 is credited to the Capital Account (or, if necessary, to a private drawing account), which is now ruled off.

In continuing each account for the following year, the amount of the balance is carried forward on the opposite side, thus:—

CAPITAL ACCOUNT.

		£	s.	d.		£	s.	d.
1909	To Balance c/d ... (carried down).	1,150	0	0	By Bank	1,000	0	0
					,, Interest	50	0	0
					,, Profit & Loss a/c	100	0	0
		£1,150	0	0		£1,150	0	0
1910.					By Balance b/d (brought down).	1,150	0	0

By transferring all the balances to the respective opposite sides the Balance Account may be made up; but as this only amounts to the balance-sheet with the sides reversed, the Drs. of the balance-sheet becoming the Crs. of the Balance Account, this has no particular value, provided the balance-sheet has already been made up.

In the more formal systems of book-keeping, the items of the Profit and Loss Account and Balance Account are journalised, but this is not by any means essential.

The system described herein furnishes the actual profit or loss on the whole of the farming operations for the year, and it will probably be best for the beginner to become thoroughly accustomed to this before attempting the more difficult process of analysing the gains or losses from the various branches.

This involves a careful dissection of—

1. The proportion of rent to be charged to each.
2. A strict appropriation of the labour, both of the farmer and his family, and the wages men.

3. A close estimate, first of the cost of the upkeep of the horses, and then of the amount to charge per hour to the crops for teams, implements, &c.
4. An approximation of the value of the feed of the horses, stock, &c., to be credited to the Crop Account.

This involves such an amount of calculation, and so many transfers and adjustments, that it is likely to deter the beginner from continuing with his books, but to the man thoroughly interested in his work they present no difficulty. The principle is the same throughout, the object aimed at being to charge each branch of the business, for which an account is kept, with the whole of the direct and indirect expenses which it involves, or from which it benefits, and to credit it with its due proportion of the receipts, in order to ascertain the real profit or loss on that particular branch.

Valuations of Stock.

There is a decided difference of opinion as to whether the ordinary live stock on the farm should be valued in accordance with the fluctuations of the market or at a uniform figure consistent with age and quality. The former method shows the value that would be realised if the stock were sold; but even in a time of inflated prices they cannot be disposed of, as they are required for carrying on the farm operations. In such cases, the method may show profits which are not actually secured, while during a period of low prices, it may indicate losses that are not really sustained. Valuation at a regular, conservative price per head is on this account to be preferred, and on definite disposal the true loss or gain can be ascertained.

Repayments of Principal with Interest.

When land is obtained as a conditional purchase or a homestead selection, where repayments are being made under a loan from the Advances to Settlers' Board, and in fact whenever payments include interest with the principal, it should be noted that the principal is reduced by the total amount of the payment, less the interest.

For instance the 18th payment of £15 on a C.P. of £400 consists of £9 principal and £6 interest, and should be journalised thus,

	£ s. d.	£ s. d.
Land a/c (or Loan a/c)	9 0 0	....
Interest a/c, Dr.	6 0 0	....
To Bank	....	15 0 0

The former reduces the total liability, whereas the latter is an expense for the current year.

Capital Cost.

Where a property is being constantly improved, a distinction should be made between permanent additions and current expenses. The former appear in the balance-sheet as assets, while the latter become part of the Profit and Loss Account. For instance, an orchardist who purchases unimproved land and gradually clears, fences, and plants the ground as circumstances permit, would probably utilise the space between the trees for the

first few years for general crops and thus support himself. Under such conditions he might only charge to a Land or Orchard Account the actual outside costs.

Assuming the purchase in 1901 of 47 acres at £7 per acre, clearing 12 acres at £4 10s., fencing for £64, wire-netting £12. ploughing and subsoiling (by contract) 45s. per acre, trees 70s. per 100 (22 feet apart), wages for planting, three weeks at 30s., and selling timber for £23;

In 1902, clearing 10 acres at £4 15s., fencing at £26, wire-netting £4, first ploughing, &c., 45s. per acre, trees £30, wages £4, selling timber for £21;

In 1903 clearing 14 acres at 90s., fencing £12, wire-netting £2, first ploughing, &c., 45s., trees £47 5s., planting £7, and selling timber £14;

The net cost to date of the orchard would then be as follows:—

SPECIMEN ORCHARD ACCOUNT.

	Dr.	£	s.	d.	*Cr.*	£	s.	d.
1901	To Purchase of Land ...	329	0	0	By Sale of Timber ...	23	0	0
	,, Clearing	54	0	0	,, Balance c/d (net cost			
	,, Fencing	64	0	0	to date) ...	505	6	0
	,, Wire-netting ..	12	0	0				
	,, Ploughing	27	0	0				
	,, Trees	37	16	0				
	,, Wages Planting ..	4	10	0				
		£528	6	0		£528	6	0
1902	To Balance b/d ...	505	6	0	By Sale of Timber ...	21	0	0
	,, Clearing, &c. ...	100	0	0	,, Balance c/d (net cost			
	,, Trees and Wages ...	34	0	0	to date)	618	6	0
		£639	6	0		£639	6	0
1903	To Balance b/d ...	618	6	0	By Sale of Timber ...	14	0	0
	,, Clearing	63	0	0	,, Balance c/d (net cost			
	,, Fencing, &c. ...	45	10	0	to date)	767	1	0
	,, Trees and Wages ...	54	5	0				
		£781	1	0		£781	1	0

It will thus be seen that such an account gives a brief history of the owner's expenses in laying out his orchard; and on the start of the fourth year, capital outlay will probably cease and a return be forthcoming. This, however, is best credited to a Fruit Account, and becomes one of the gross profits for the year. The question of making some small allowance for depreciation on such an orchard can only be left to the owner's judgment and knowledge of local conditions. Renewals and a gradual replacement of trees when needed can be charged as current expenses.

The Plant Book.

Where the implements in use are of a mixed character and have varying lengths of effective life, making a fixed depreciation on the whole undesirable, a special plant book may be used with decided benefit. This may be ruled

according to circumstances and the insertion of other particulars may add to its value.

Name of Implement (and if necessary where procured.)	Date of Purchase.	Cost.	Probable Life.	Amount of Depreciation.	Value at end of 1910			Value at end of 1911.			Value at end of 1912.			Value at end of 1913.		
		£	Years		£	s.	d.	£	s	d.	£	s.	d.	£	s.	d.
4-furrow plough .	18-1-'10	20	4	25 % or £5	15	0	0	10	0	0	5	0	0	.	.	.
Horse gear . .	20-2-'10	16	20	5 % or 16s.	15	4	0	14	8	0	13	12	0	12	16	0
Spring cart	28-2-'10	18	10	10 % or 36s.	16	4	0	14	8	0	12	12	0	10	16	0
Reaper and binder.	23-3-'10	40	5	20 % or £8	32	0	0	24	0	0	(Sold, £20)			..		

The addition of all these items will give the valuation of the plant for the current year. Any period longer than six months may be taken as a year, and all under that time neglected.

The plough may possibly have a nominal value at the end of the fourth year, and this can be put down in the column, if desired. The price, £20, for the binder will be credited to the Plant Account in the usual way, and it thus drops out of the valuations for the year.

Consignments Outwards.

In nearly all text-books this phrase is used to express the forwarding of goods to be sold by an agent at a distance, and separate accounts for each consignment are opened. Unless, however, considerable delay elapses between the sending and disposal, such transactions are best treated as ordinary sales, dealing only with the net return. If, however, time is likely to elapse before the sale, as when stock are sent to another district for disposal at a favourable opportunity, a Consignment Account may be opened. Under such circumstances, a value should be assigned to the stock, and this should be debited to the Consignment Account, together with all charges paid by the owner or consignor. The net return, as shown by the account sales, should be credited to the same account, which will now indicate whether a loss or a gain has been made on the deal. Any over-estimate at the outset will be rectified by the account sales. The use of such an account becomes of considerable importance when stock happens to be away at the time of making up a balance-sheet.

Conclusion.

Enough has been said to indicate a few of the salient points connected with book-keeping on the farm. Other books for recording the receipts of cash, the doings of the labourers, transactions in bills, &c., may be used where the operations are extensive, or where further details are desired; but their use involves little difficulty after the elementary stages have been passed and they can be ruled to suit varying conditions.

The treatment of the subject on the broadest possible lines, consistent with accuracy, has been strongly recommended to the beginner throughout, and as advancement is made in the work much greater detail may be entered upon. The whole system is thoroughly progressive and educational, and when undertaken with sincerity and thoroughness, and with the expenditure of a little mental effort, cannot fail to help the farmer in his work, broaden his ideas, increase his knowledge of the business, and make him happier and more satisfied with the life he has chosen.

Bathurst Experiment Farm.

Annual Report of Demonstration Area for Year 1909.

R. W. PEACOCK.

At the beginning of the year an area comprising 180¾ acres was set apart at this farm as a Demonstration Area. The main object for such is to carry the experiments of past years to their logical conclusion, and prove that the practice recommended for others to follow can be carried out profitably upon commercial lines at this farm.

The system which has been decided upon is one of mixed farming, the principal lines being sheep and wheat. Unfortunately the area is not large enough for the purpose, but was all that could be spared from the experimental and educational sections of the farm. A compact block of land was chosen, comprising some of the best and some of the poorest land on the farm, and typical of the majority of the farms throughout the district.

A plan of the whole area is given, showing the subdivisions and also the broken nature of some of the paddocks, which adds materially to the cost of working. The short turnings with ploughs, drills, and other machinery, as well as the irregular conformation of some of the fields, will convey to the practical man some of the disadvantages, such as increase of draught, wear and tear on machinery, &c., &c. The variations respecting the costs of ploughings are accounted for by the varying conditions of the soil at the time of ploughing, the number of shares used, &c., and by the individual doing the work.

In taking over the area at the beginning of the year there were disadvantages which will not occur in future years, but which militated against the returns of this season. For instance, Paddock No. 6 was under maize, which was harvested during April. The area gets no credit for any portion of this crop. Also, in Paddock No. 4 a few acres were under cowpeas, which are not considered in these returns. This necessitated this area being under bare fallow for the whole year. As a set-off against this, two of the paddocks had the advantage of being ploughed a short time in 1908.

The operations upon the area have as far as possible been carried out on commercial lines, and the cost of the smallest item has been charged against it. The labour throughout the year has been kept as nearly as possible down to the basis of a farmer and his son, excepting throughout the harvest and a very few other busy periods.

The plant of horses, implements, and machinery also has been kept within limits possible to the ordinary farmer. The question whether this area will show a cash surplus after debiting all legitimate charges against it upon the selling of its produce is to me of small importance; but the question whether a farmer could carry out the same practice upon his own farm at a profit is a vital one.

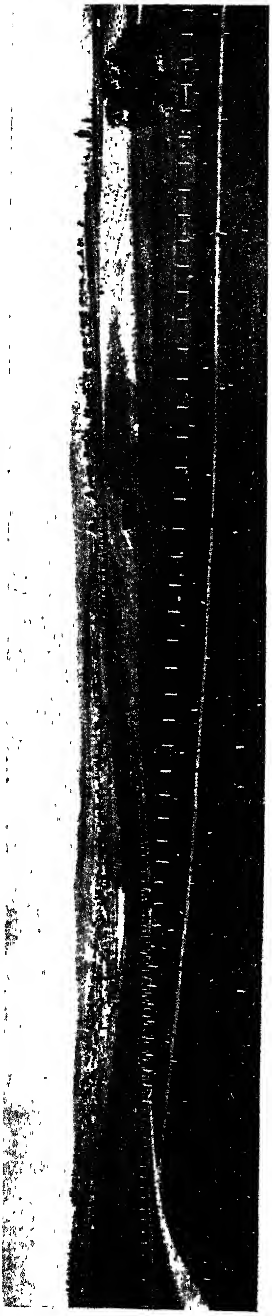


Fig. 1.—General view of Demonstration Area, Bathurst Experiment Farm.

The most essential differences exist between farming carried on under the regime of a Government institution, and farming as carried out on a private farm; the most important being that personal interested supervision which is brought to bear upon every detail by the working owner and his interested family as against the most conscientious labour of a Government employee. This personal interest is a most potent offset against even the keenest thought, intelligence, and enthusiasm brought to bear by the person in control, especially when that person has many duties outside those under review.

The portion of this report which should prove more valuable than the statement of expenditure and receipts is the details of the practice followed, taken with the results. Each farmer should know what these operations would cost him, and judge accordingly, and not by what it has cost a Government institution under somewhat impossible conditions.

The history of the area in the main should be a record of the best practice known to the manager of the farm. A few slight variations will from time to time be apparent, and represent a few cultural risks for the sake of expediency, which may be legitimately taken by any farmer. Such should be reduced to a minimum. I refer to such practices as sowing wheat for hay directly a crop of maize is taken off.

As regards the stocking of the fodder crops, it was found impossible to dissociate the farm stock from the area and carry stock of its own upon it, without interfering with the valuable sheep experiments in progress for many years. The farm stock, sheep, cattle, and horses were utilised to make use of the fodder grown. The basis of calculation to reduce the stocking to the equivalent of one sheep, was the following:—

Mare and foal, equal to 10 sheep.
Horse, equal to 10 sheep.
Cow, equal to 8 sheep.
Lambs, first month, not considered.
Second month, 4 lambs equal to 1 sheep.
Third month, 2 lambs equal to 1 sheep.

Forty-seven and one-eighth acres were under fodder crops for sheep. Rape and Cape barley

Fig. 2.—View of Paddock No. 11, Demonstration Area, Bathurst Experiment Farm. Cleveland Wheat in foreground, and Federation being harvested.

and rape and rye were sown in alternate drills. This area carried an equivalent of six sheep per acre for an average period of five months. It is exceedingly difficult to get at a proper valuation of this fodder. A good ewe, at a low estimate, should return from 10s. to 12s. per annum in wool and lamb.

The value of the fodder from the area for five months could reasonably be computed at £1 per acre. The wages paid to the farm employees engaged on the area are 7s. per day of eight hours. The student labour has been rated £1 per week of forty-eight hours.

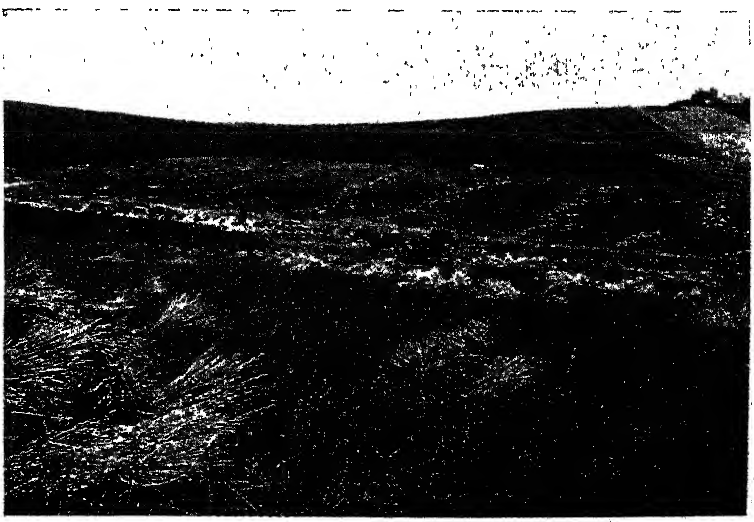


Fig. 3.—Field of Federation Wheat, Demonstration Area, Bathurst Experiment Farm.

The value of horse feed has been computed at 8s. per week. This has been based upon £4 per ton for chaff, and 4s. per bushel for grain. The groom's wages are 49s. per week of seven days. The capital value of the land has been placed at £8 per acre for 180¾ acres. A portion of this, comprising 7⅓ acres, is not arable, making the cost per acre equivalent to rent of the arable portion on a 5 per cent. basis of 8s. 4d. per acre.

The cost of all cultural operations will be charged against each crop from the time the preceding crop was harvested or otherwise disposed of.

Pages 519 to 525 contain a detailed statement of expenditure and receipts pertaining to the various paddocks, exclusive of interest on, and depreciation of, plant.

As regards the cost of threshing from Paddock No. 6, it will be seen that such is excessive. This was due to the use of a small peg drum thresher,

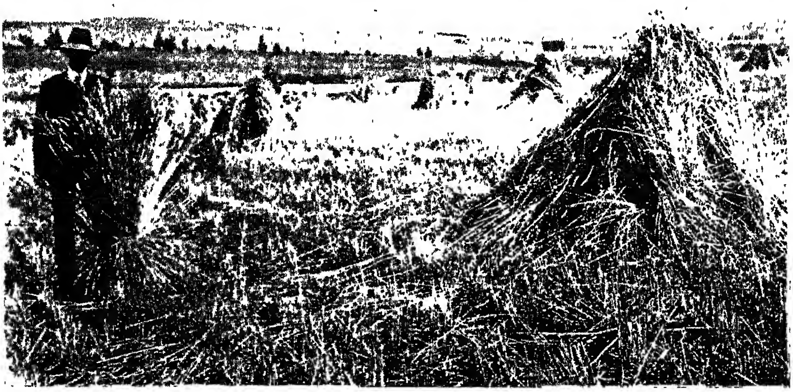


Fig. 4.—Bobs Wheat, Demonstration Area, Bathurst Experiment Farm.

which allows of thorough cleaning from all grains before commencing another variety, which is impossible with large threshing plants. This extra charge is one which should be debited against the production of pure seed, and not against ordinary milling samples. The cost of threshing in the Bathurst district to the ordinary farmer is approximately 5⅓d. per bushel, estimated on the following basis :—

Farmer pays contractor 7d. per three-bushel bag=2⅓d. per bushel. Owner of machine provides three men—engine-driver, band-cutter, and feeder. Farmer pays sixteen men.

	£	s.	d.
Twelve get 5s. per day and four meals=8s. per day ...	4	16	0
Four get 6s. per day and four meals=9s. per day ...	1	16	0
Three contractor's men meals at 3s.	0	9	0
Wood per day	0	10	0
	£7	11	0

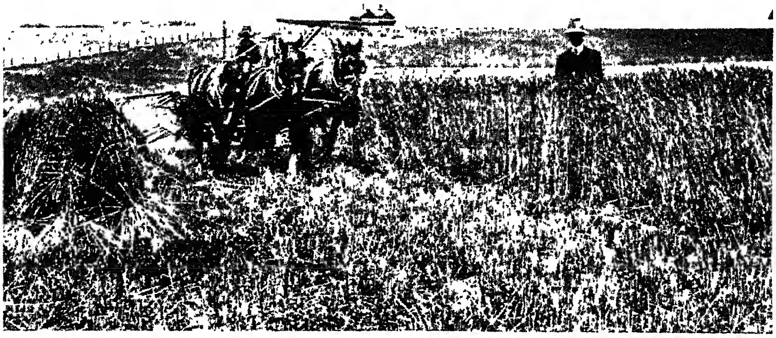


Fig. 5.—Federation Wheat, Demonstration Area, Bathurst Experiment Farm. Yield, 36¾ bushels per acre.

Estimated average of work per day, 600 bushels for £7 11s. 0d.=$3\frac{1}{50}$d. per bushel. Total cost=$5\frac{53}{150}$d. per bushel.

Also, the charge for cleaning and awning barley would have been met in the original threshing, but owning to the thresher here having no chobber and awner it had to be put through a separate machine, increasing the cost.

In Paddock 11 the expenditure was increased considerably owing to the neglect of an employee. Instead of covering the stacks, which were out of sight from the buildings, the tarpaulins were folded up on top, and a storm of 360 points fell during the night whilst they were uncovered. This necessitated the stacks having to be pulled down and the sheaves dried,

Fig. 6.—Carting Hay, Demonstration Area, Bathurst Experiment Farm.

and again restacked. Unfortunately, owing to further rains drying was delayed considerably, resulting in a large proportion being unfit for seed, and classed as second grade. The expenditure was thus increased, and the receipts materially reduced.

Owing to the toughness induced by the rain, grain was lost in the threshing, and also in the excessive handling, which tended to reduce the yields. This goes to prove that the keen personal interest of the owner is an important factor in success.

In discussing the Profit and Loss Account of this area, it is well to realise that the wages paid to the employee and one lad would be a living for a farmer and his son. In many cases, farmers only receive reasonable remuneration for the labour expended by themselves and members of their

Fig. 7.—Stacking Hay, Demonstration Area, Bathurst Experiment Area.

families, they doing the most of the work on the farms. The working farmer who knows his business has a decided advantage as regards management over one who simply provides the capital and depends solely upon hired labour. The interested personal attention of the owner to detail is an important factor in mixed farming. The output and profits per acre from small holdings, managed and worked by their owners, are greatly in excess of those from large holdings owned by men or companies who depend upon hired labour solely.

Large farming ventures, both in Australia and America, have not given commensurate returns, excepting where specialised farming is carried on under favourable natural conditions not ordinarily existent.

The farmer naturally takes risks, and under certain conditions may have to be content with less than the minimum wage for his labour, but against this he has a reasonable expectation of substantial profits when seasons are good and prices satisfactory.

Fig. 8.—Threshing Wheat with large threshing plant, Bathurst District.

The greatest difference between the expenses on this area and those of the ordinary farm is the excessive cost of threshing, which is increased considerably when the interest and depreciation of the threshing plant are added. Such plants ordinarily do considerably more work throughout the year, thus reducing the cost of threshing per bushel. The increased cost represents 4¼d. per bushel.

In any system of wheat-farming the cost of the production of a bushel of wheat is of the greatest importance. The cost upon this area this year of a milling sample was 2s. 8½d. per bushel. This, reduced by the extra cost of threshing, would leave the cost of production at 2s. 4¼d. This should be considered highly satisfactory, considering the high capital value of the land, the wages paid, the small irregular paddocks, and the high valuation of plant in proportion to area operated on.

Wheat can be produced for less upon the large level wheat areas in a climate allowing of such labour-saving machinery as the combined harvester.

Fig. 9.—Threshing with small threshing plant, Bathurst Experiment Farm.

The cost of plant has been based upon prices whilst new. The repairs of new machinery would be very slight, and practically only breakages should be made good the first year.

The depreciation of 10 per cent. would be in excess of actual depreciation of some of the implements and machinery, and assumes ten years to be the life of them. Such would be the case as regards horses, harness, &c. A binder would not last as long, whereas portable engine, ploughs, cultivators, drill, &c., would last longer. Therefore, 10 per cent. has been struck as an average rather in excess of the actual.

Also, owing to the smallness of the area, the total depreciation and interest upon plant should not be charged, as all of it does an equal or greater amount of duty upon the other portions of this farm. Therefore, only half or less is chargeable against the Demonstration Area. It is debited as half, viz., £432 7s. 6d., total cost of plant being £864 15s.

It is unfortunate that absolute figures cannot be given in many cases owing to the area being run conjointly with an experimental and educational institution. Nevertheless, the report provides data upon which the farmers may place their own values; and also proves that a Demonstration Farm should not be run conjointly with an experimental and educational institution, but rather should be of sufficient area and in every way self-contained.

Plant.

	£	s.	d.
Seven horses, at £30	210	0	0
Trolly, at £50	50	0	0
Cart, at £15	15	0	0
Ploughs—Six-furrow (one)	25	0	0
Double furrow (two)	36	0	0
Seed drill	40	0	0
Cultivator, Massey Harris	18	0	0
Maize drill	6	0	0
Maize marker	1	0	0
Binder	40	0	0
Three tarpaulins	15	0	0
Ladders (two)	2	10	0
Wheat-grader	69	0	0
Threshing machine	300	0	0
Swingle bars	3	5	0
Harness	30	0	0
Pitchforks, Shovels, Picks, Buckets, &c.	2	10	0
Casks (three)	1	10	0
	£864	15	0

Summary of Expenditure and Receipts.

	Expenditure. £	s.	d.	Receipts. £	s.	d.
Paddock 1	52	14	3	102	13	7
" 1A	8	5	0	7	3	9
" 2 (part)	15	14	10	38	8	0
" 2 "	18	10	0	18	3	2
" 2A	15	8	4	15	7	2
" 5	7	13	8	6	8	2
" 6	62	17	3	111	18	2
" 10	7	16	2	9	10	6
" 11	134	1	6	279	8	8
" 12	70	18	10	133	2	6
Tending stock on area ...	10	0	0			
Half interest on plant, valued at £864 15s., at 5 per cent. ...	21	12	4			
Half depreciation on plant, at 10 per cent.	43	4	9			
Credit balance	253	6	9			
	£722	3	8	£722	3	8

Credit balance, £253 6s. 9d.

Proceeds from Operations.

	£	s.	d.
Seed wheat sold	200	2	0
Seed wheat on hand	214	10	0
Milling wheat on hand	83	4	9
Tailings taken over by farm for pigs and poultry	7	14	5
Seed barley sold	10	12	4
Barley on hand	28	3	2
Barley straw sold...	1	10	0
Hay taken over by farm for horses	104	11	0
Straw on hand	28	11	6
Beeswing chaff taken over by farm for sheep	15	2	6
Green fodder taken over by farm for stock	56	12	9
Half value crop of maize	38	8	0
	£789	2	5

The apparent discrepancy between this total and that of the estimated receipts from the various paddocks, as shown in summary, is mainly due to the increased price received for seed wheat and barley over the estimates as appearing under statement for each paddock. In the summary, estimates were kept rather against the area than in its favour.

Statement of Profit or Loss of each Paddock.

		£	s.	d.	
Paddock No. 1	profit	3	9	9½	per acre
Paddock No. 1A	loss	0	2	11½	"
Part Paddock No. 2 (fodder crop)	loss	0	0	4½	"
Part Paddock No. 2 (maize)	profit	1	16	1¾	"
Paddock No. 2A	loss	0	0	1	"
Part Paddock No. 5	loss	0	3	11¾	"
Paddock No. 6	profit	1	19	4½	"
Paddock No. 10	profit	0	2	8½	"
Paddock No. 11	profit	4	12	9¾	"
Paddock No. 12	profit	2	9	10½	"

Profit per acre on whole area of 180¾ acres, £1 8s. 0¼d. per acre.

Extra Cost due to production of pure Graded Seed.

	£ s. d.	£ s. d.
Paddock No 1.		
Pulling stray plants ...	0 17 5	
Increased cost of threshing 329 bushels, at $4\frac{1}{4}$d. per bushel ...	5 16 6	
Cleaning and grading ...	3 3 2	
Carting to barn ...	0 6 7	
		10 3 8
Paddock No. 11.		
Pulling stray plants ...	1 14 1	
Increased cost of threshing 796 bushels, at $4\frac{1}{4}$d. per bushel ...	14 1 11	
Cleaning and grading ...	6 15 1	
Carting to barn ...	1 4 3	
		23 15 4
Loss in grading $16\frac{5}{8}$ bushels, at 4s. ...	3 7 0	
Depreciation and interest on grading and cleaning machinery ...	9 16 10	
		13 3 10
		£47 2 10

Increased cost over milling sample, $10\frac{1}{20}$d. per bushel.

Notes on the Crops.

Federation.—Generally speaking, the crops grew too rank for best results in grain production. The growth of Federation in Paddock No. 11 was excessive, and the estimated yield of hay per acre was 4 tons 11 cwt. This was estimated by cutting a small portion for hay, and weighing after thorough drying. The weights as given are equivalent to stacked hay. The yield of grain was $36\frac{3}{4}$ bushels per acre.

Cleveland, in the same paddock, was sown upon the poorest portion—a piece so poor that it was considered necessary to apply the heavy dressing of 1 cwt. per acre of superphosphate. This heavy dressing was, in all probability, not too much for the poorer portions, but it certainly was for the richer soil at one end of the paddock, and did in some measure reduce the yield of grain. The estimated yield for hay was 3 tons 10 cwt. per acre, and the yield of grain was $31\frac{3}{4}$ bushels per acre.

Bobs, in Paddock No. 1, was rather disappointing, and did not act up to its reputation of past years. The growth of straw was excessive, and, owing to heavy wind storms, a considerable portion lodged. This fact, in conjunction with the depredations of sparrows, seriously affected the yield. The estimated yield of hay was 3 tons 13 cwt. per acre, and the yield of grain was $25\frac{1}{4}$ bushels per acre.

In Paddock No. 12 the wheat was sown at the rate of $21\frac{4}{5}$ lb. per acre. It unfortunately was sown at a very dry period, most unsuitable for germination. This necessitated the bulk of the grain having to wait for rains before sprouting. These were not readily forthcoming, the result being that a percentage malted. This, coupled with the fact that the seed was sown rather deeply, owing to the seed-bed being like ashes, and causing the wheels of the drill to sink, led to very faulty germination. The Experimentalist computed that only 5 lb. per acre germinated. After careful observation, I concurred in this view. It is very possible that the

formalin treatment had a bad effect upon the germination of the grain, as it has been proved that formalin-treated grain may fail to germinate at certain variable periods after application. This is the weak spot in the formalin method.

The plantlets were extremely weak and unthrifty for a considerable time.

The yield of 22¾ bushels per acre, under the circumstances, was exceptionally good; but owing to its being a large paddock it materially reduced the general average.

The system of manuring followed was to apply, excepting in the instance stated above, about 56 lb. of superphosphate per acre, and to throw the manure distributor out of gear when drilling the richer portions of the paddock, only applying fertiliser to the weaker portions. Such was done in the light of past experiments, which have proved that it is very easy to over-feed the wheat-plant when grain is the objective.

In the choice of varieties, a late maturing wheat, Cleveland, was chosen for early, and Federation and Bobs for the mid-season to late sowings. These varieties had in the past given consistent yields, and the two first have acted up to expectations. The average yield for the whole area under wheat was 28¾ bushels per acre. The official estimate for the whole district for 1909 was 14 bushels per acre.

The yields of hay ranged from 30 cwt. per acre directly following maize to over 4 tons per acre. The rainfall for 1909 was 21·96 inches, distributed as follows:—

January	... 317	May	... 54	September	... 277
February	... 289	June	... 226	October	... 174
March	... 151	July...	... 35	November	... 121
April	... 155	August	... 184	December	... 213

This is nearly 2 inches below the average, and followed an exceptionally dry cycle of eight years. The rainfall for 1908 was 15·89 inches. It will be noticed that 6·06 inches fell during January and February, two of the hottest months, also that a very creditable fall came in December, too late to benefit the wheats, and was preceded by a dry spell of hot weather which was not calculated to improve the crops.

Soil Culture.

The whole of the area was worked under the new system of soil culture advocated at this farm, the main principle of which is the production of loose, open, or self-mulching surfaces. It is claimed that such remain in condition much longer after heavy rains than do those which are compressed by roller or broken to a fine state of tilth by disc cultivator or roller or ordinary harrows. Every operation is performed with the object of keeping coarser particles of the soil at the top and the finer below. For this purpose mould-board ploughs are used and not discs; the springtooth cultivator

instead of disc or other implements, as it is found that the springtooth has a sifting action upon the soil particles and brings the coarser particles to the top. Organic matter, such as 10 inches of stubble after the binder, and residues of crops are encouraged to remain at the surface to prevent the surface beating together by heavy rains. This ensures loose open surfaces. The various operations on paper appear very similar; but it is not the performance of a certain operation which makes a system, but the manner in which it is done to bring about a given result. At this farm ploughing, cultivating, and sowing are carried out, but all are done differently to the ordinarily accepted, or what may be termed "orthodox" principles.

I do not intend discussing in full the system followed, which has already appeared in the Sydney dailies. Results must speak for me. It is only fair to the system to add that it has been misinterpreted and misrepresented since its publication.

A few of the salient points as published in the original paper are appended.

The author claims for his system the production of self-mulching surfaces. These self-mulching surfaces lead to the deepening of the soil and free access of rains. They prevent evaporation, surface rooting, germination of weed seeds and erosion on undulating country, and tend to considerably increase the yield.

The new practice must first be grasped, and kept intelligently in view, to be advantageously followed. It, in common with any other system of soil culture, may be abortive in the hands of one individual, whilst entirely satisfactory with another, so much depends upon doing the right thing at the right time.

There are four conditions of soil-particles deserving of special attention, viz., dust, granules, crumbs, and clods. The aim should be to keep the dust at the bottom, the granules next, then the crumbs and the clods on top. Whether such is attained depends largely upon the skill of the operator and the implements used.

Self-mulching surfaces may be granular, granular and crumbly, granular crumbly and cloddy, or those kept loose and open by incorporating stubble, straw, residues of crops, leaves and roots of grasses and herbs; or may be composed of granular or crumbly clays such as many of the calcareous clays. The object should be to keep the surface loose and open; no compression should be allowed, excepting under exceptional conditions.

An application of fresh farmyard manure to the surface 3 inches may make it so loose and open as to throw it out of action.

Throwing the surface out of action:—This may be attained as above, or by mixing a sufficient quantity of fresh straw or stubble with the first 3 inches, or by bringing the crumbs and clods to the top, and allowing them to remain in a loose condition. This condition does not allow of the retention of moisture sufficiently long to support the vital roots of plants. Farmers are warned against throwing too much of the surface of shallow soils out of action too quickly. The subsoil may not be ameliorated quickly enough to take its place in plant nutrition. It may take several years to increase the depth of the soil 6 inches.

Every point has been fully discussed in the original paper read before the Australian Association for the Advancement of Science, which met at Brisbane in 1909. I still claim, after a further twelve months' trial, that the maximum returns from a minimum expenditure under any given set of conditions are obtainable by an intelligent application of the system.

Paddock No. 1a.—Area, 7·19 acres.

Expenditure.

		£ s. d.
28/1/09.		
One ploughing, 4 inches deep, with six-furrow plough with student labour. Total cost, £1 9s. 4d. = 4s. $0\frac{3}{4}$d. per acre		1 9 4
Seed—		
Cape Barley, 4 bushels 8 lb., at 5s.... ...	£1 0 9	
Rape, 32 lb., at $3\frac{3}{4}$d. = 10s....	0 10 0	
Average 4s. $3\frac{1}{4}$d. per acre for seed ...		1 10 9
Manure—		
$6\frac{1}{2}$ cwt. superphosphate, at £4 16s. 3d. per ton, including freight = 4s. $4\frac{1}{4}$d. per acre		1 11 3
6/2/09.		
Sowing with drill, horses and labour, nearly 2s. per acre ...		0 13 9
Rent, 7·19 acres, at 8s. 4d. per acre		2 19 11
		£8 5 0

Receipts.

	£ s. d.
Estimated value of fodder, £1 per acre	7 3 9
Commenced feeding 5/4/09, fed intermittently till 25/9/09. Carried 4·7 sheep per acre for a period of 173 days.	
Debit balance	1 1 3
	£8 5 0

Part of Paddock No. 2.—Area, 18·16 acres.

Expenditure.

		£ s. d.
19/2/09.		
Ploughing with six-furrow plough, student labour, 2s. $7\frac{1}{2}$d. per acre		2 8 4
Seed—		
Rye, 5 bushels 9 lb., at 5s.	£1 5 9	
Rape, 61 lb., at $3\frac{3}{4}$d.	0 19 1	
Average 2s. $5\frac{1}{2}$d. per acre		2 4 10
Manure—		
$19\frac{3}{4}$ cwt. superphosphate, at £4 16s. 3d. per ton = 5s. 1d. per acre		4 12 6
24/2/09.		
Drilling, 1s. $9\frac{3}{4}$d. per acre		1 13 0
Rent, 18·16 acres, at 8s. 4d. per acre		7 11 4
		£18 10 0

Receipts.

	£ s. d.
Estimated value of fodder, £1 per acre	18 3 $2\frac{1}{2}$
Commenced feeding 19/4/09, fed until 11/9/09. Carried 6 sheep per acre for a period of 145 days.	
Debit balance	0 6 $9\frac{1}{2}$
	£18 10 0

Paddock No. 2a.—Area, 15·36 acres.

Expenditure.

		£ s. d.
10/2/09.		
Ploughing with six-furrow plough, student labour, at 3s. 2½d. per acre ...		2 9 6½
Seed—		
3 bushels 29 lb. Cape barley, at 5s. ...	£0 17 11	
50 lb. rape, at 3⅞d. ...	0 15 8	
Average 2s. 2¼d. per acre...		1 13 7
Manure—		
Superphosphate, 15½ cwt., at £4 16s. 3d. per ton, = 4s. 10¼d. per acre ...		3 14 7
18/2/09.		
Drilling, 1s. 5¾d. per acre ...		1 2 8
Rent, 15·36 acres, at 8s. 4d. per acre ...		6 8 0
		£15 8 1½

Receipts.

	£ s. d.
Estimated value of fodder, £1 per acre ...	15 7 2½
Commenced feeding 3/5/09; fed until 28/9/09.	
Carried 6·7 sheep per acre for 148 days.	
Debit balance ...	0 1 2
	£15 8 4½

Part of Paddock No. 5.—Area, 6·41 acres.

Expenditure.

		£ s. d.
9/1/09.		
Ploughing with three and four furrow ploughs, at 4s. 9½d. per acre ...		1 10 9
22/2/09.		
Reploughed with six-furrow plough, labourer and student, at 2s. 8d. per acre ...		0 17 1
Seed—		
Rye, 2 bushels 6 lb., at 5s. ...	£0 10 6	
Rape, 21 lb., at 3¾d. ...	0 6 6	
Average 2s. 7¾d. per acre ...		0 17 0
Manure—		
4½ cwt. superphosphate, at £4 16s. 3d. per ton, at a cost of 3s. 4½d. per acre ...		1 1 8
26/2/09.		
Drilling, at a cost of 2s. 1¾d. per acre...		0 13 9
Rent, 6·41 acres, at 8s. 4d. per acre ...		2 13 5
		£7 13 8

Receipts.

	£ s. d.
Estimated value of fodder, at £1 per acre ...	6 8 2
Commenced feeding 17/5/09; fed until 27/9/09.	
Carried 6·4 sheep per acre for 133 days.	
Debit balance ...	1 5 6
	£7 13 8

PADDOCK No. 6.—Total area, 25·01 acres; arable area, 24·9 acres.

Maize occupied this paddock until the 28th April, and is not credited to this area.

Expenditure.

		£ s. d.
14/5/09.—Ploughing, two-furrow plough, student and labourer, at 6s. $2\frac{3}{4}$d. per acre.		
Part 5·62 acres under barley ...	£1 15 $0\frac{3}{4}$	
Part 19·28 ,, ,, wheat for hay ...	6 0 $4\frac{1}{4}$	
		7 15 5
Seed—Barley, 173 lb. at 5s., at a cost of 3s. $0\frac{1}{4}$d. per acre ...	£0 17 3	
Wheat, 13 bushels 31 lb., at 6s. = 4s. $2\frac{1}{2}$d. per acre ..	4 1 1	
		4 18 4
Manure—On part barley ...	£1 6 $0\frac{3}{4}$	
,, for hay ...	4 9 $5\frac{1}{4}$	
		5 15 6
Drilling—18/5/09.—Barley, at 2s. 1d. per acre ...		0 11 9
21/5/09.—Wheat, at 1s. $10\frac{1}{2}$d. per acre ...		1 15 8
Rent on part barley, at 8s. 4d. per acre ...		2 6 10
,, ,, wheat, at 8s. 4d. ,, ...		8 0 8
Pulling out stray plants (labour) ...		1 7 5
Reaping barley—Wages and horses ...	£0 7 3	
$27\frac{1}{2}$ lb. twine, at $5\frac{1}{2}\frac{4}{5}$d. ...	0 12 9	
= 3s. $6\frac{3}{4}$d. per acre.		1 0 0
Stooking barley, at 1s. $8\frac{3}{4}$d. per acre ...		0 9 $8\frac{1}{2}$
Carting and stacking barley, at 5s. $0\frac{1}{4}$d. per acre ...		1 8 $2\frac{1}{2}$
Bags for barley, 64 bags, at $5\frac{1}{8}$d. per bag ...		1 7 4
Cutting wheat for hay—Cutting hay, at a cost of 1s. 10d. per acre...		1 15 5
Twine, $105\frac{1}{2}$ lb., at $5\frac{1}{2}\frac{4}{5}$d per lb., the rate of 2s. $6\frac{1}{2}$d. per acre		2 8 11
Stooking hay, at a cost of 1s. $8\frac{9}{10}$d. per acre ..		1 13 7
Carting and stacking hay, at 7s. $11\frac{1}{4}$d. per acre ...		7 13 0
Covering of stack (barley) ...	£0 1 11	
,, ,, (hay) ...	0 1 8	
Ploughing around stacks ...	0 2 0	
		0 5 7
Threshing barley, $190\frac{4}{5}$ bushels, at $8\frac{3}{4}$d. per bushel ...		7 0 2
Carting barley to barn ...		0 4 11
Cleaning and awning barley ...		1 11 0
Thatching hay stack ...		3 4 7
Digging drain around stack ...		0 3 3
Credit balance ...		49 0 11
		£111 18 2

Receipts.

	£ s. d.
$190\frac{4}{5}$ bushels barley, at 4s ...	38 3 2
Barley straw, 3 tons ...	1 10 0
Hay estimated at 30 cwt. per acre = 28 tons 18 cwt., at £2 10s. per ton in stack ..	72 5 0
	£111 18 2

Cost of ploughing, reaping, &c., must be increased by proportion of interest and depreciation on plant.

PADDOCK No. 1.—Total area, 17·76 acres; arable area, 14·32 acres.

Expenditure.

				£	s.	d.
Rent, at 8s. 4d. per acre ...				5	19	4
First ploughing, double furrow, 9·32 acres, at 7s. 7$\frac{9}{10}$d. per acre				3	11	5
Skim-ploughing with six-furrow, 5 acres, at 1s. 8$\frac{1}{2}$d. per acre				0	8	5
Second ploughing, two and three-furrow plough, about 7 acres, at 4s. 2$\frac{1}{2}$d. per acre				1	9	5$\frac{1}{2}$
Cultivating balance of paddock, at 1s 6$\frac{1}{2}$d. per acre...				0	11	4$\frac{1}{2}$
Cutting and carting weeds				0	1	9
Seed, 6 bushels 21 lb. wheat, at 6s	£1	18	1			
Treatment, Labour, 1s. 4d.; formalin, 6$\frac{1}{2}$d. ...	0	1	10$\frac{1}{2}$			
				1	19	11$\frac{1}{2}$
Manure, 5$\frac{3}{4}$ cwt., at £4 16s 3d per ton = 1s. 11$\frac{1}{4}$ per acre ...				1	7	8
Drilling, at 1s. 9$\frac{1}{4}$d. per acre				1	5	5
Pulling out stray plants ...				0	17	5
Cutting headlands for hay, 1·36 acres ...	£0	7	2			
Twine	0	2	10			
Stooking headlands for hay, 1·36 acres...	0	3	6			
Carting and stacking do do	0	13	1			
				1	6	7
Cutting 12·96 acres for grain, at 2s. 8d.	£1	14	8			
Twine, 60$\frac{1}{2}$ lb. = 2s. 2d. per acre	1	8	0			
				3	2	8
Stooking, at 1s. 11$\frac{1}{4}$d. per acre ...				1	5	9
Carting and stacking, at 9s. 9$\frac{3}{4}$d. per acre				6	7	1
Covering and uncovering stack ...				0	3	9
Ploughing around stack ...				0	1	2
Threshing with small machine, 10$\frac{3}{4}$d. per bushel				14	15	11
Bags, 110, at 5$\frac{1}{8}$d. approximately				2	7	0
Carting to barn ...				0	6	7$\frac{1}{2}$
Recleaning and grading, 2·29d. per bushel				3	3	2
Cartage to rail, 1$\frac{1}{2}$ miles ...				0	12	4
Estimated cost of thatching straw stack				1	10	0
Credit balance ...				49	19	4
				£102	13	7

Receipts.

				£	s.	d.
Hay from headlands, 1·36 acres, at 3 tons per acre = 4·08 tons, at £2 10s. per ton ...				10	2	0
329 bushels 34 lb. graded into the following grades:						
1st.—189 bushels 16 lb., at 6s. ...	£56	15	7			
2nd 55 bushels 46 lbs., at 4s	11	3	0			
3rd.—5 bushels 54 lb., at 3s. 6d.	1	0	6			
Tailings, 20 bushels 54 lb, for fowls, at 2s.	2	1	9			
Slightly damaged by rain, 55 bushels 58 lb., at 4s.	11	3	9			
				82	4	7
Straw, estimated at 1 ton per acre 12 tons 19 cwt., at 10s....				6	9	6
Beeswing chaff for sheep, 7$\frac{3}{4}$ tons, at 10s. ...				3	17	6
				£102	13	7

Thatching of straw-stack not completed upon writing report.

PADDOCK NO. 11.—Total area, 33·94 acres ; arable area, 31·32 acres.

The first ploughing of this paddock was done before the area was set apart, and no accounts were kept. The cost is estimated upon the cost of ploughing similar soil in Paddock No. 1, which amounted to 7s. $7\frac{9}{10}$d. per acre.

The estimate would be in excess of actual cost, as Paddock 11 was larger, and furrows longer.

Expenditure.

				£	s.	d.
Rent, 31·32 acres, at 8s. 4d. per acre ...				13	1	0
Ploughing, 31·32 acres, at 7s. $7\frac{9}{10}$d. per acre ...				11	19	10
Ploughing roadway ...				0	6	2
Ploughing, with three and six-furrow ploughs, 31·32 acres, at 3s. $5\frac{1}{2}$d. per acre...				5	8	6
Seed—						
11 bushels 33 lb. of Federation, at 6s. per bushel ...	£3	9	3			
4 bushels 56 lb. of Cleveland, at 6s. per bushel	1	9	7			
Treatment, Formalin and labour ...	0	5	0			
				5	3	10
Manure, 15 cwt., at £4 16s 3d. per ton...				3	12	2
Drilling, at 1s. $10\frac{1}{8}$d. per acre ...				2	17	9
Cutting of hay, 2·3 acres, at 4s. $2\frac{1}{4}$d. per acre ...	£0	9	$7\frac{1}{2}$			
Twine, at 2s. $11\frac{1}{4}$d. per acre ...	0	6	9			
Stooking, 2·3 acres, at 3s. 9d. ...	0	8	$7\frac{1}{2}$			
Carting and stacking, at 12s. $4\frac{1}{4}$d. per acre ...	1	8	5			
				2	13	5
Ploughing around stacks ...				0	7	2
Pulling out stray plants ...				1	14	1
Cutting wheat, 29·02 acres, at 2s. $5\frac{7}{10}$d. per acre...	3	10	6			
Twine, $153\frac{1}{2}$ lb., at $5\frac{1}{25}$d. per lb.=2s. $5\frac{1}{3}$d. per acre	3	11	1			
				7	1	7
Stooking, at 2s. $1\frac{9}{10}$d. per acre ...				3	2	7
Carting and stacking, at 8s. $2\frac{3}{8}$d. per acre ...				11	18	6
Covering and uncovering stacks ...	2	4	2			
Drying and restacking wheat ...	4	16	0			
				7	0	2
Threshing, at $8\frac{3}{8}$d. per bushel ...				37	13	6
Bags, 344, at $5\frac{1}{8}$d. per bag ...				7	6	11
Carting wheat to barn ...				1	4	3
Recleaning and grading of Federation ...				6	15	1
Cartage to rail, $1\frac{1}{2}$ miles ...				1	15	0
Estimated cost of thatching straw ...				3	0	0
Credit balance ...				145	7	2
				£279	8	8

Receipts.

	£	s.	d.
Hay from 2·3 acres, at 3 tons per acre=6 tons 18 cwt., at £2 10s per acre ...	17	5	0
Federation, 796 bushels—			
1st grade, 478 bushels, at 6s. per bushel ...	143	8	0
2nd grade, 32 bushels 42 lb., at 4s. per bushel ...	6	10	9
3rd grade, 8 bushels 12 lb, at 3s. 6d. per bushel ...	1	8	8
Tailings, white-heads, &c., 22 bushels 44 lb., at 2s. ...	2	5	5
Damaged by rain, 241 bushels 19 lb., recleaned, yielding as follows :—			
Milling sample, 228 bushels 30 lb., at 3s. 6d. per bushel	39	19	9
Cleanings, &c., 4 bushels 34 lb., at 2s. ...	0	9	1
Cleveland—This has not yet been graded. Valued at milling rates—			
235 bushels 12 lb., at 4s. per bushel ...	47	0	9
Straw, estimated, 29 tons, at 10s. per ton ...	14	10	0
Beeswing chaff, $13\frac{1}{8}$ tons, at 10s. per ton ...	6	11	3
	£279	8	8

PADDOCK No. 12.—Area, 26·59 acres.

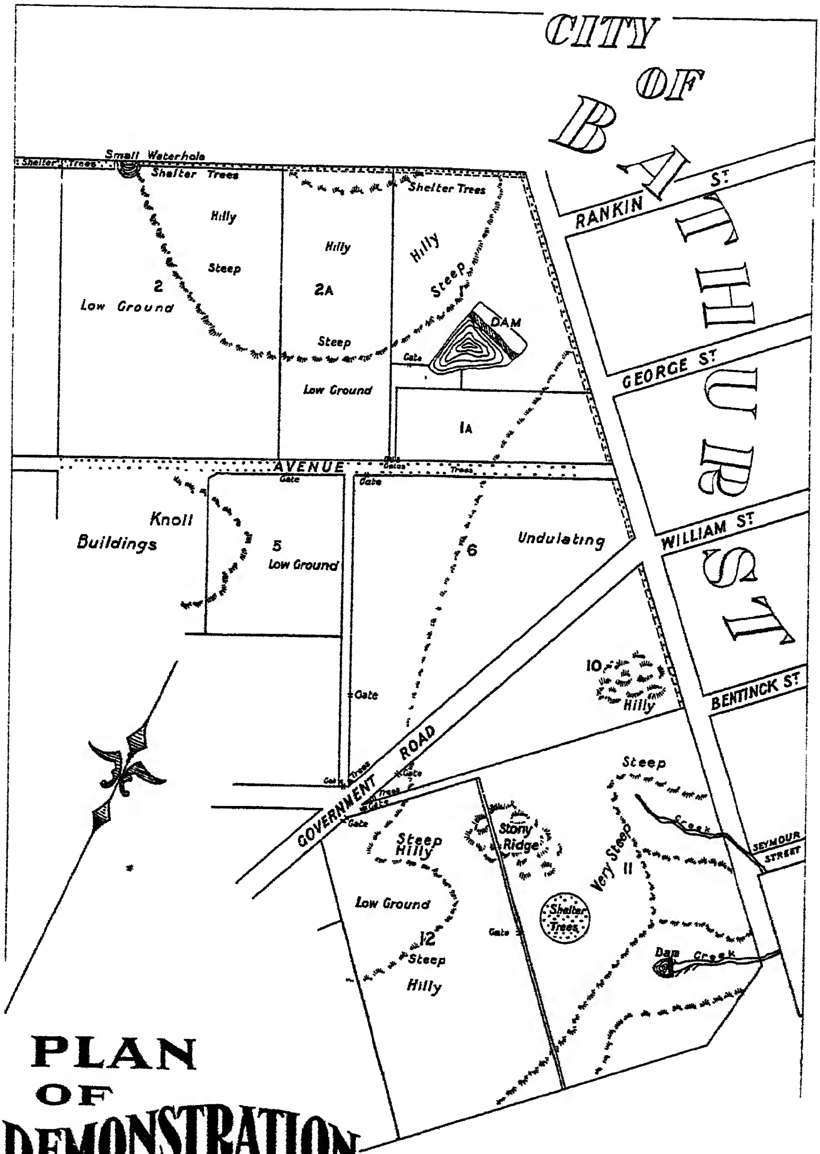
The first ploughing was done before the area was set apart and accounts kept. Its cost is estimated at the same price as the second ploughing with double furrow, viz.:—6s. 4¼d. per acre.

Expenditure.

				£	s.	d.
Rent, at 8s. 4d. per acre ...				11	1	7
First ploughing, at 6s. 4¼d. per acre ...				8	9	0
Second ploughing, at 6s. 4¼d. per acre...				8	9	0
Seed, 9½ bushels, at 6s. ...	£2	17	0			
Treatment for bunt ...	0	2	6			
=2s. 2⅞d. per acre ...				2	19	6
Manure, 9¾ cwt., at £4 16s. 3d. per ton, at 1s. 9⅛d. per acre ..				2	6	11
Drilling, at 1s. 5¼d. per acre ...				1	18	6
Pulling out stray plants ...				1	15	8
Cutting headlands for hay—						
1·29 acres, at 1s. 11⅛d. per acre ...	£0	2	6			
Twine, 5 lb., at 1s. 9⅓d. per acre ...	0	2	4			
Stooking ...	0	3	6			
Carting and stacking ...	0	10	4			
				0	18	8
Cutting wheat, 25½ acres, at 1s. 7⅛d. per acre...	£2	0	4			
Twine, 75 lb., at 1s. 4½d. per acre ...	1	14	9			
				3	15	1
Stooking, at 1s. 1⅛d. per acre ...				1	7	11
Carting and stacking, at 4s. 10⅓d. per acre ...				6	2	11
Ploughing around stack ...				0	2	8
Covering and uncovering stack ...				0	1	0
Threshing, 578¾ bushels, at 5¾d. per bushel ...				13	18	9
Bags, 193, at 5⅛d. ...				4	2	5
Carting wheat to barn ...				0	17	3
Carting wheat to mill (estimated cost)...				1	2	0
Estimated cost of thatching straw ...				1	10	0
Credit balance ...				62	3	8
				£133	2	6

Receipts.

	£	s	d.
Hay from 1·29 acres, at 30 cwt. per acre=1 ton 18½ cwt., at £2 10s. ...	4	16	3
578¾ bushels, at 4s. ...	115	15	0
Straw, at 12 cwt. per acre=15 tons 3 cwt., at 10s...	7	17	6
Beeswing chaff, 9⅜ tons, at 10s. ...	4	13	9
	£133	2	6



PLAN OF DEMONSTRATION AREA AT BATHURST EXPERIMENTAL FARM

PADDOCK No. 10.—Area, $12\frac{7}{10}$ acres.

This paddock was under lucerne for grazing prior to taking over of area.

Expenditure.	£	s.	d.	Receipts.	£	s.	d.
Rent, at 8s. 4d. per acre ...	5	5	10	Fodder, value estimated at 15s. per acre per annum, based upon the carrying of 4 sheep per acre for eight months...	9	10	6
Cultivating with spike roller ...	1	12	6				
Cultivating with Massey-Harris Cultivator ...	0	17	10				
Credit balance ...	1	14	4				
	9	10	6		9	10	6

PADDOCK No. 2.—Portion under maize, 12·81 acres.

Expenses to end December, 1909.

Expenditure.	£	s.	d.	Receipts.	£	s.	d.
Rent, at 8s. 4d. per acre ...	5	6	9	By half of crop, estimated at 40 bushels per acre, at 3s. per bushel ...	38	8	0
Ploughing, six-furrow, 12·81 acres, at 2s. 7½d. per acre ...	1	13	6				
Ploughing, double furrow, at 5s. 8½d. per acre ...	3	13	3				
Cultivating, at 1s. 6½d. per acre...	0	19	8				
Marking drills, at 9¾d. per acre...	0	10	4				
Seed, 49 lb., at 7s. 6d. per bushel, at the rate of $3\frac{4}{5}$ lb. per acre = 6d. per acre ...	0	6	6				
Manure, 6¾ cwt., at £4 16s. 3d. per ton; cost per acre, 2s. 6½d. ...	1	12	6				
Drilling, at 1s. 4½d. per acre ...	0	17	8				
Chipping weeds ...	0	4	8				
Credit balance ...	23	3	2				
	38	8	0		38	8	0

Our Experiment Farms.

J. E. O'GRADY.

BATHURST.

Manager—R. W. Peacock.
Registrar—F. H. Harvey.
Experimentalist—[Vacant.]
Orchardist—W. H. Grant.
Acting House Master—O. A. Banner.
Farm Foreman—E. Hamer.

ON the rolling uplands, overlooking the city of Bathurst, the Government established an Experiment Farm sixteen years ago. The situation is extremely picturesque, and typical of the beautiful Bathurst tableland, one of the oldest agricultural districts of Australia. Attention is attracted by the absence of native timbers, the luxuriant growth of willows along the water-courses, and the numerous brown haystacks dotting the cleared paddocks. The pioneer's work has been done in Bathurst district, and agricultural investigation must be directed towards improvement in established methods, and the discovery and application of means of preserving and restoring soil fertility in what is, for Australia, a district long under the plough.

The farm covers an area of 670 acres, 16 of which are detached and located on the banks of the Macquarie, about 1½ miles from the main farm, where an irrigation plant is at work. This irrigation area will form the subject of a future paper.

Over all but a limited area the soil is *in situ,* and has been weathered from granite rocks. It ranges from light to heavy loam, with a clay subsoil.

The operations at Bathurst are divided into three sections—Educational, Experimental, and Demonstrational.

The main lines are mixed farming, in which sheep and wheat figure largely, and orchard work. There are 40 acres of orchard, principally apples, for which the district is most suitable. Owing to the results obtained in the past the inducements have been sufficient for men to place under orchards a considerable area throughout the district. About 300 acres of new orchards have been planted during the past few years. Bathurst bids fair to become one of the leading apple-growing districts of the State, and in the near future the beneficial influence will be felt in the city and district.

There is accommodation at the farm for thirty-two resident students, and at the time of writing twenty-nine are on the farm. They receive a varied practical training in mixed farming, and a limited number take special courses in apple culture and orchard work generally. A house-master is in residence to give elementary instruction in the sciences underlying agriculture. Mr. J. Wrenford Mathews, Sheep and Wool Expert, gives instruction in his special branch, and Mr. C. J. Sanderson, M.R.C.V.S., Government Veterinary Surgeon, lectures in veterinary science.

Bathurst Farm has, in common with the other Experiment Farms, done its share in establishing facts, which will quietly but materially influence for good the agricultural practice of the district and of the State. Some years ago the cry of the depletion of our soils led many farmers to the extravagant use of fertilisers. Bathurst has proven, not by laboratory experiment, but by actual field demonstration, that it is quite easy to over-manure wheat grown on granitic soil of this quality, and that the excessive use of fertilisers may result not only in waste of expensive material, but even in reduced yield of grain. Experiments in manuring are continuously in progress at Bathurst, and results are published in the *Gazette* from time to time, consisting of uninteresting-looking tables of figures, but worthy of careful study by farmers who consider the question of manuring. Mr. Peacock finds that phosphoric acid, in the form of superphosphate, is the plant-food which gives best results at present. The rotation of crops, the principle which ensures the maximum production, is found to modify considerably the effect of fertilisers, and field experiments with manures in a rotation of crops are now in progress. These will, of course, extend over several years before final results will be available; but the results will stand as a guide, supplying information which it would take a farmer years of patient experiment and observation to acquire for himself.

The effect of various rotation crops upon the fertility of the soil is also being tested, and such crops as rape, clover, and barley are under observation, in conjunction with the growth of wheats. A large number of grasses and fodder-plants are also grown, and their habits and value ascertained.

The cross-breeding of sheep, for the production of wool and mutton, is a problem for every district of the State; the breeding of early-maturing lambs for export purposes is one of the most essential points in mixed farming. These problems, in which the whole of Australia is vitally interested, are being investigated at Bathurst, as at the other Government farms in sheep districts. Experiments have been carried out at Bathurst for many years, and already data of considerable value to the small holder have been obtained and published.

The Demonstration Area, 180 acres, is a farm pure and simple. By direction of the Minister, this area was set apart last year for the practice, as nearly as possible under farmers' conditions, of the methods which have been found to be the most suitable to the district. Strict separate accounts are kept of the operations and returns from the area, the whole being intended to indicate to farmers the results which will be obtained by following the recommendations of the officers of the farm.

The annual report on the Demonstration Area for the year 1909 is published in this issue. It will be seen from that report that the average yield of wheat from the area cropped was 28¾ bushels, and that yields of 36¾ bushels of wheat, and 4 tons 11 cwt. of Federation hay, per acre were obtained in paddock No. 11. The average for the district that season was 14 bushels. It will also be seen that, after charging the area with the cost of all operations, with rent at the rate of 8s. 4d. per acre per annum, and

with its proportion of the interest and depreciation on the plant used, a net return of £1 8s. per acre has been obtained.

Mr. Peacock claims that these results are largely due to the employment of his new system of soil-culture, which is in use on the Demonstration Area, as on the remainder of the farm. This "system," he states, has been misinterpreted and misunderstood, and, with a view to obtaining full particulars of the methods which he recommends, the writer paid a special visit to the farm.

Mr. Peacock's "system" is not an aggregation of detailed cultural operations; it is a doctrine, founded on a new interpretation of long-established physical laws. Whether that interpretation is a correct one the writer is not competent to say, but that it has been misunderstood there is no doubt whatever. To say that it requires the use or disuse of a particular cultural implement, or the performance or non-performance of a particular cultural operation, is to betray a want of conception of the basic principles, and is unfair to Mr. Peacock. The mouldboard plough is preferred to the disc because its action tends more towards the production of the condition of the soil which Mr. Peacock desires; the spring-tooth cultivator is only recommended when and where it has the same tendency. The roller, an implement which must be used with judgment in farm practice, may, under certain conditions of soil and moisture, be advantageous. Upon the Demonstration Area Mr. Peacock has not, so far, used the roller, but he admits its value under certain conditions. It is difficult for one trained in the orthodox rules of agriculture to grasp effectively Mr. Peacock's "system," because of the very fact that it is based upon a new conception of universally accepted laws. His reasoning must be comprehended and applied to the circumstances of the particular field before even a fair experimental trial can be made. To use Mr. Peacock's laconic expression, you must not approach the subject with "a clod in your eye."

To secure the maximum return from a crop of wheat under Australian conditions, the soil must be made to assist in many respects which are common to agriculture in all countries; but our temperature and rainfall bring the following items into prominence:—

1. Rain must have free access to the soil, whether it falls in sudden downpours or in steady, misty showers. It is none too plentiful, even within the recognised wheat belt, and it must not be allowed to run off.

2. Moisture must be prevented as much as possible from evaporating from the soil. In the best wheat districts the rain falling during the early stages of the crop is all required, and in the drier districts it is necessary to conserve moisture in the soil for some time previous to seeding in order to secure germination.

3. Air must have access to the soil particles in order to encourage the weathering of the soil, thus rendering plant-food available, and also to enable the necessary bacterial action to proceed.

4. Weeds must be prevented from growing, or strictly kept down. Besides the space which they occupy in the soil and the crop, they take moisture from the soil, interfere with harvesting operations, and generally reduce yields.

5. Undulating country must be prevented from erosion by the action of heavy rains. In many districts the bulk of the rainfall is received in a few heavy storms, which result in temporary creeks, washing away the seed or young crop, with the soil which has been specially preserved or prepared for the plants, and exposing the unweathered and unproductive subsoil. This should be prevented.

Now all this is very elementary and very trite; but it is in these respects that Mr. Peacock claims to have evolved a "system" in advance of the methods hitherto practised and taught. We will take the five points in order, and consider his reasoning.

1. *Free Access of Rain.*—If rain is to enter the soil there must be space for it to enter. A fine, dusty surface will be compacted by water; and, especially if it is composed of tenacious material, it will soon become puddled and water-tight, as does the bottom of a tank in clayey ground. The rain must then run off. A loose, open surface allows the water to percolate freely to the underlying soil and subsoil. A very loosely-packed surface permits a large proportion to fall through by gravitation, taking the finer particles of soil with it, instead of being absorbed slowly by capillarity, as is the case with more compacted and fine surfaces. Consequently, says Mr. Peacock, the surface should be loose and open.

2. *Prevention of Evaporation.*—Water is evaporated from the soil by the action of the sun and winds. The orthodox method of prevention is to keep the surface fine, so that it will act as a blanket. But as this fine condition of the surface encourages the ascent of the moisture to the surface by capillary attraction, the accepted practice is to continually disturb the surface by cultivation, thus breaking the capillary connection and keeping an effective mulch. Mr. Peacock's method of preventing evaporation is to ensure a loosely-packed surface, in which the air spaces are comparatively large. The effectiveness of a loose, dry mulch of organic matter, such as straw or stubble, is recognised the world over. The value of a mulch composed of the loosely-packed coarser particles of the soil is what Mr. Peacock wishes to impress upon our minds. If such a mulch is obtained *and retained,* it is, in his mind, all that is required in this connection. Capillarity cannot act upon stones, nor upon loosely-packed clods, which dry quickly on account of the large surface which they expose to the air.

It is here that Mr. Peacock has been largely misunderstood. The mere breaking of the soil into rough clods by the plough has no great advantages; the formation and retention of a loose, open, dry mulch is, he claims, the best method of retaining moisture. Capillary moisture cannot readily travel up, and the finer soil below retains the moisture by surface tension. The surface particles are dried by the sun and winds, and the air surrounding them must be displaced before the moisture can ascend. The moisture is

thus kept in the sub-surface, and the evaporating surface is several inches below the apparent surface, effectively protected from sun and winds by the loosely-packed, coarser particles of soil. Mr. Peacock claims that the moisture is virtually trapped; that it falls through the surface mainly by the law of gravity, is held by the finer particles below by surface tension, and is distributed by capillarity. Instead of coming to the surface, the water soaks laterally and downwards into the soil, where it is conserved.

The mulch may be loose, dry clods; or organic matter such as straw or stubble mixed with the surface soil; or granular and crumbly clay, such as many of the calcereous clays. Rains falling upon such a surface will pass through into the soil, taking with them the finer particles of the surface and the water-soluble plant-food, which becomes concentrated in the seed-bed below. Continuous heavy rain will, of course, tend to break down the mulch, when it must be restored as soon as possible. But Mr. Peacock claims that this mulch will withstand heavier weather than the orthodox one, and has the additional advantage that the soil below is, by weather agencies, working into condition, instead of out of it.

3. *Free Admission of Air.*—The loose, open surface admits air freely; a fine, compacted surface is impervious to air, or nearly so. At the same time the air in the open spaces of the soil is more or less at rest, and does not form part of the air-current of the winds which carry away moisture. If an area of ground be divided by 6 feet paling fences into spaces 10 feet square, those spaces will be filled with still air, and even in heavy winds there will be no breeze inside the spaces. So it is, says Mr. Peacock, with the spaces in the soil, protected and sheltered by the loose mulch. Persistent pounding of the surface soil may result, after heavy rains, in a 50-acre clod, as impervious to air and moisture as a tramped floor.

4. *Suppression of Weeds.*—Most of the weeds which trouble the farmer have small seeds, much finer than wheat grains; such seeds will not germinate at any great distance below the surface. But *nothing* can germinate in a dry mulch, consequently the weed seeds find a difficulty in germinating at all. Wheat, on the other hand, is, or can be made, a deep-rooting plant. Its roots have been found at Bathurst Farm 3 feet 8 inches below the crowns, in a heavy clay subsoil. Mr. Peacock claims that his "system" induces deep sub-surface rooting, which enables a wheat plant to better withstand drought; but that a compacted, fine surface has an opposite tendency.

5. *Erosion of Undulating Country.*—If the surface is such that rain cannot enter the soil, the water will collect on the surface and form channels in the soil; but if the rain enters the ground at once there is no surface water accumulating to do damage.

Mr. Peacock therefore considers the formation and retention of a loose, dry mulch essential to best results. Such a mulch may consist of granules; granules and crumbs; granules, crumbs, and clods; or soil kept loose and open by incorporating organic matter. The most effective mulch would be 3 inches of ¼-inch gravel, as this does not retain moisture except on the external surfaces of the particles. Underneath this mulch should be the finer

particles of the soil, forming the seed-bed. A typical good soil would present, in descending order—

1. Coarser particles of the soil, or soil with organic matter incorporated.
2. Crumbs of soil.
3. Granules of soil.
4. The finest particles of the soil.

To obtain and maintain this condition of the soil is an entirely different matter from its theoretical analysis. Mr. Peacock is a practical farmer, as well as a student of soil physics, and he has given certain cultural recommendations. These, however, must be construed as largely suggestive only. The object is to carry out the underlying principles of the "system," and in many cases the practice must be suited to the conditions. Each farmer must study his own soil, and its peculiarities and possibilities. The following are his general recommendations:—

1. Plough as soon as possible after the preceding crop has been disposed of, using mouldboard ploughs. This will bring the surface soil into a loose, open condition, with the clods on top. The finer soil particles will run through the interstices between the clods and form a fine sub-surface. Of course the clods must not be too big; they should allow the crop to come up between them. There is a medium in everything. If they are too big, better roll the land to break the large clods, and directly cultivate with spring-tooth cultivator to bring about the desired condition of surface. Moreover, the general effect of the method is to work upon the subsoil, and throw the surface out of action. If a large proportion of the surface soil is thrown out of action before the subsoil has been sufficiently ameliorated by weathering agencies to take its place in plant nutrition, good results cannot be expected. Mr. Peacock claims that it may take years to bring about this desirable deepening of the soil, and he warns farmers against throwing too much of the surface out of action.
2. If the soil has not a granular texture, it will not remain in the desired condition, and steps must be taken to form an effective mulch. This may best be done by incorporating stubble or other organic matter with the surface soil. The organic matter should not be ploughed deeply into the soil, but merely incorporated with the surface.
3. The surface soil should be maintained in this loose, open condition. Rain in sufficient quantity, according to the texture of the soil, will damage the mulch by destroying the clods. This should be corrected by cultivation. Mr. Peacock claims that the surfaces which he advocates remain in condition much longer than what are termed "orthodox" surfaces, and the necessity for cultivation does not occur so frequently. A spring-tooth cultivator may be used, or a multiple-furrow plough, which can be run through the loose soil very cheaply. When a second ploughing is given, the furrows should be run at right angles to those of the first ploughing.

4. Some weeds will probably grow. These must be destroyed by cultivating again with spring-tooth, or preferably with multiple-furrow plough.
5. Sow with a seed drill. If the soil below the mulch is not sufficiently compact, use a "sub-surface compressor," a narrow steel bar fitted with set screw, trailing below the surface after the hoe, which is weighted to compress the soil around the deposited seed. The action of the implement is beneath the surface, and the loose crumbs will fall back into position as the implement passes on.

These are the best recommendations which Mr. Peacock can make with implements now on the market, but the general adoption of his principles would create a demand for specially constructed implements, and this demand would soon be filled. The excessive use of disc and other implements which act upon the actual surface, breaks down the compound granular or crumbly particles of the surface soil into dust—a practice which he strongly condemns. Implements which cultivate below the surface, and have a sifting action, bringing the coarser compound particles to the surface, are the only ones that have a place in his system.

To demonstrate the efficiency of his methods, Mr. Peacock points to his farm. Amongst other evidence, he showed the writer a paddock of freshly germinated lucerne on sloping ground. About 45 points of rain had fallen ten days previously, but with that exception there had been no rain for six and a half weeks. The surface was composed of rough clods, which were perfectly dry; underneath this there were dry granules, and beneath this again fine soil, in which the lucerne seed had germinated. This soil was so damp that it would form a paste if pressed in the hand. There was a beautiful stand of lucerne amongst the rough clods.

The Department has not endorsed Mr. Peacock's system, as outlined by him in his first essay. The system is the subject of practical trial and experiment—one of the chief purposes for which the Department was created. It may be ultimately proved to be right or wrong, or partly right and partly wrong. The land from which 36¾ bushels of wheat per acre were obtained is there for inspection—Paddock No. 11, a stony hillside, across the road from the back of St. Stanislaus' College. It is now under rape and barley, sown in alternate drills.

Meanwhile, a practical farmer will see much to interest him, apart from cultural systems, by visiting Bathurst Farm. The instruction is varied and complete; the culture is a demonstration of clean, effective work; the rotation and other experiments can be seen in progress, and the effect judged; the orchard work shows the possibilities of the district in apple-growing; and, generally, Bathurst and its future would have much to lose by the abandonment of the farm and the cessation of its educational influence.

Trials of Varieties of Kale at Bathurst Experiment Farm.

R. W. PEACOCK.

KALE has considerable value as a fodder for dairy cattle, sheep, pigs, and poultry in districts which are sufficiently cool and moist, but its cultivation is not recommended in the drier and hotter parts of the State. Experiments

Fig. 1.—Jersey Tree Kale, Bathurst Experiment Farm.

have recently been made at the Bathurst Farm to test the value of several varieties. Marrow Kale (*Chou moellier*) was tested alongside Jersey Tree and Thousand-headed Kales, both under irrigation and upon the uplands.

The following are the estimated results per acre :—

Variety.	Estimated yield.				Proportion of stem to leaf.
	t.	c.	q.	lb.	per cent.
Under Irrigation.					
Jersey Tree	21	19	3	6	18·3
Marrow	20	9	2	2	48·6
Thousand-headed	19	4	0	2	18·9
On Uplands, without Irrigation.					
Jersey Tree	8	11	3	3	
Marrow	9	4	2	27	
Thousand-headed	6	16	0	14	

These results show that, under irrigation, Jersey Tree gave the best yield, followed by Marrow and Thousand-headed; whilst on the uplands, Marrow Kale gave the largest crop, Jersey Tree and Thousand-headed following in the order named, though the differences in yield between the three varieties were not great. In the case of Marrow Kale, however, the large proportion of stem to leaves (48·6 per cent.) would in some measure discount its value, notwithstanding that it is edible. The dry summers in the Bathurst District interfere with the successful culture of these plants.

Fig. 2.—Marrow Kale, Bathurst Experiment Farm.

Fig. 3.—Thousand-headed Kale, Bathurst Experiment Farm.

They should be sown in drills from 3 to 4 feet apart during the autumn, and subsequently thinned by cultivating across the rows, leaving the plants from 2 feet 6 inches to 3 feet apart. Good results are obtained by sowing in seed beds and transplanting into well-prepared soil during favourable weather.

In the cooler districts, under favourable conditions, they provide fodder throughout the year. Their most serious pests are the cabbage moth and aphis.

Turkeys: In Health and Disease.

[Continued from page 452.]

G. BRADSHAW AND A. L. WYNDHAM.

Turkeys in Australia.

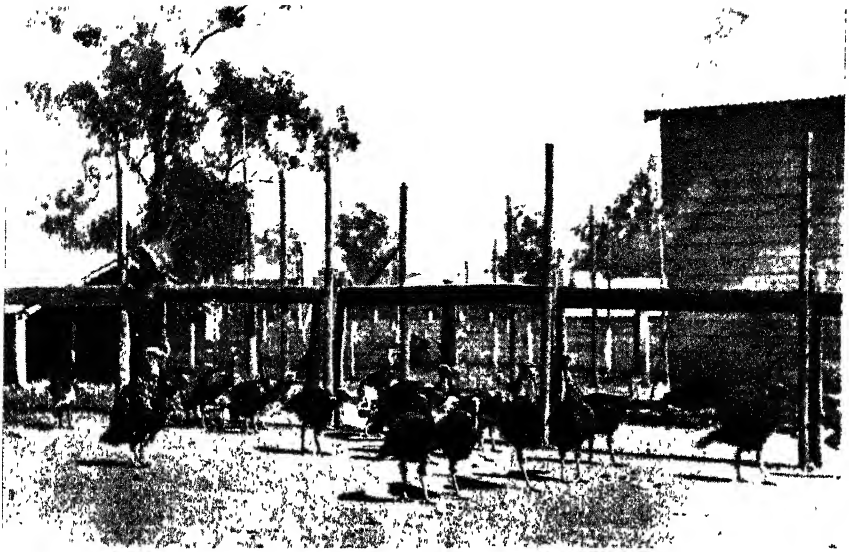
POULTRY-KEEPING in Australia dates from the arrival of Governor Phillip, the nucleus of our domesticated feathered stock arriving by the first fleet. But while the records tell us the quantity of mares, sheep, goats, and pigs with which the Governor commenced breeding operations, the poultry were merely described as "some fowls and turkeys."

That the climatic and other conditions then obtaining were favourable to poultry-breeding can be realised from a return made three months after landing, when the stock of the first poultry farm in Australia counted 28 turkeys, 29 geese, 35 ducks, 142 fowls, and 87 chickens. Five rabbits are also mentioned.

In connection with the enumerating of the stock of the then Colony, it is worthy of note that while such took place regularly, and the number of sheep, goats, cattle, horses, &c. were duly recorded, feathered stock were usually referred to as "a quantity of poultry." This is quite excusable, for as the flock had increased by eighty-seven chickens in three months, one can understand the difficulty there would be in getting the numbers two or three years afterwards, particularly as conditions allowed for a semi-wild life, favourable to success in breeding. There is ample evidence, for Phillip wrote in September of his first year of settlement that of seventy sheep all had died but one; two bulls and four cows had "walked off," and the balance had died; but the hogs and poultry were thriving.

Sydney Cove, however, was not the only place where fowls thrived well. One writer in 1790, in describing the agricultural farm established at Rosehill, says:—"Without a large supply of cattle nothing can be done. They have not any at this time, either horse, or cow, or sheep." "Fowls," he said, "multiplied exceedingly"—a statement borne out by the market rates. In 1792, while flour was up to 1s. per lb.; maize to 15s. per bushel; potatoes, 3d. per lb.; and cheese, 2s. 6d. per lb., cocks for killing could be had for 4s. to 5s.; laying hens, 5s.; and eggs, 3s. per dozen. Two years later turkeys were quoted at £2 2s. per pair, a price below that obtaining in our own markets at certain seasons at the present time. The comparatively low price is explained by the fact that at that period, even in England, birds never approached half the weight of those of the present day.

Poultry-breeding, of whatever sort, one hundred years ago or more, was carried on in a perfunctory way. There were but few breeds of fowls, and what were then known as pure breeds of turkeys were the Norfolk and Cambridge; and old records tell us the heaviest gobbler's weight was but about 14 lb. In connection with those which came by the first fleet, supposing



Flock of Bronze Turkeys, Wagga Experiment Farm.

Bronze Turkey Hens, Wagga Experiment Farm.

they were the heaviest then obtainable in England, despite the adaptable conditions here for their cultivation and the acknowledged good thriving of the poultry, in the absence of fresh blood they would deteriorate in size, and the records are silent as to further importations.

Captain McArthur, writing home to his brother in 1794 about his stock, among other things, says:—"Poultry of all kinds I have in the greatest abundance." In 1796 the live stock of the Colony were again enumerated, and all showed a great increase. Pigs were the most plentiful of all the quadrupeds, numbering 1,869, while poultry were stated to be numerous; and the prices were indicative of such, for while mutton was 2s. per lb., goat, 1s. 6d., and pork 1s. 3d, fowls and ducks were but 5s. each, geese and turkeys a guinea, and eggs but 2s. per dozen—a lower price than is obtaining in our market at time of writing.

In 1807 the price of mutton was 2s. per lb., but fowls kept at the reasonable rate of 5s. each, and turkeys £1. In 1801 a census of the stock was again taken, but as before, poultry through their numbers and their semi-wild state, were beyond enumeration.

When the second and succeeding arrivals of turkeys came to the Colony is unrecorded, but it is thought that about 1850, when poultry breeding was in the throes of a boom in England, the butchers and stewards of the ships trading to our port in wool and other merchandise, regularly brought consignments of all classes of thoroughbred poultry, and found a ready sale for them on arrival in Sydney Harbour. The breeds then were the Norfolk and Cambridge, and the few which did reach here had comparatively small effect on the stock of the colony, the records telling us that 8 to 10 lb. were good weights for hen turkeys, and 12 to 15 lb. for gobblers.

When or by whom the first of the Bronze breed were introduced is unknown, but about thirty years ago two or three consignments came to a breeder in Victoria from England. They were, however, many pounds below the reputed weights of the breed, and he next tried America with better success. Several trios had reached this State prior to the period mentioned. They also failed in size, but were a considerable advance on the Norfolk and Cambridge.

In the eighties, and a decade later, the ship "Illawarra," which made yearly voyages here for wool, on every trip fetched prize stock, and twenty-four years ago one of the writers recollects seeing on this ship a pair of the Bronze variety in a consignment of other poultry, purchased for the late Carlo Marino, who later on introduced others from both England and America.

The effect of the numerous importations has been to very much increase the individual weights of many Australian flocks, but others are deteriorating for want of fresh blood.

Turkey Breeding and Rearing.

Of all the sorts of domestic poultry it is generally acknowledged that turkeys are the most difficult to bring to the adult age, the young birds in the early stages requiring very special care until they get over the period termed "shooting the red." Indeed the great trouble experienced in rearing

deters some farmers from venturing on this business, which to many is a most lucrative one. In other words, many have tried turkey breeding with rearing results so disastrous that it was given up in disgust, while others experience less trouble in bringing the poults to maturity than they do with ordinary chickens. It must not be thought that the success depends on the experience of the breeder; it depends largely on the natural conditions of the place of rearing. An illustration will suffice. A friend of ours, a poultry fancier and exhibitor, twenty-five years ago, in the north of Ireland, had a great fancy for exhibiting turkeys, and year after year spent many pounds in purchasing the best English stock available; but although he had plenty of land, and every attention was given in the way of foods and up-to date methods of rearing, he was scarcely ever able to bring one to maturity. Gapes, and a score of other ailments, took the young one at every stage from the hatching to the half-grown. This man came to Australia and settled in Gippsland. Visiting him fourteen years ago, we saw large numbers of turkeys wandering over his 320 acres of uncleared, thickly-timbered country. We remarked, "You have learnt how to rear turkeys." "No," was the reply, "I have not learnt; the turkeys rear themselves here. They need no rearing." The only fatalities in rearing were due to the natural enemies of the bush, or to some of the baby turks falling into one of the numerous crab-holes of that section of Victoria.

Turkeys are the semi-wild fowl of the farm, and the rougher and more uncleared the country the more simple is the rearing. Atmospheric conditions also affect turkey-rearing for good or ill. Soil is also an element to be considered. At the same time, people neither select nor purchase land simply from its suitability to rear turkeys—larger issues are the determining factors. However, these feathered giants have been and are successfully reared in other countries on places and under conditions which many poultrymen would consider adverse to success in chicken-rearing; and as the 300,000 square miles of this State embrace soils, temperatures, natural and other conditions similar to those obtaining in every country where turkey culture is carried on, a description of the methods generally adopted in the principal of these is appended, and should form a good guide to those who purpose attempting this branch of the poultry industry; while the methods adopted at the Wagga Experiment Farm will be found to suit those who work with similar soils and conditions.

Turkey Rearing in England.

Although many of our biggest gobblers have come from America, we have had importations of immense size from England, that country being the world's breeding ground for all stock, including turkeys. Some time ago the question was asked how the rearing and feeding was done to ensure such size, and an English poultry paper offered a prize for the best article on the subject. The following was the prize paragraph:—

Rearing Turkeys.

There is an idea current in the country that turkeys are very difficult birds to rear, and thus many people do not venture upon this branch of poultry-farming, owing to

their belief in this erroneous notion. It is, however, not at all an easy matter to raise turkeys with any degree of certainty on a heavy clay soil or in a wet district, although there are places where turkey-breeding is successfully carried on under the most adverse conditions. But there must be exceptions to every rule. Turkeys are almost invariably hatched under natural conditions. Incubators have been used with a certain amount of success in some places, but the great difficulty with the artificial means of hatching is that the young turkey chicks so seldom thrive in foster-mothers, and it is not always that a hen will take to them. So, all things considered, it is best to hatch by means of a broody hen. Buff Orpington or a cross-bred nearly always proves to be the best sitters and mothers.

When the chicks are hatched and are dry, they should be moved, together with the hen, to a coop—a double one, if possible—and the hen shut in one side, while on the floor of the other part chaff should be scattered, so as to afford the birds exercise. The first thing to remember is that the crops of the turkey chicks are very small, so that they require their food in small quantities and often—every two hours for the first week or so will be none too frequent. The food for the first three or four days should consist of hard-boiled eggs and biscuit meal; the meal is steeped in hot water and the mixture is given warm. The egg may be stopped after three or four days if the young birds seem to be doing well, but it is nearly always advisable to keep on with it for at least a week. After the first week biscuit meal forms the chief food; but a variety should be employed where possible. There is one essential to successful turkey rearing—namely, onions. The best plan is to chop them up and keep them continually before the birds. Meat also should be supplied, and green food of some kind—young lettuces being about the best—is necessary, and a little green bone is often found to be of use. Such foods as mentioned should be given to the turkey chicks until they are from eight to ten weeks old, when shooting the red takes place, after which one may consider that the most trying period is over. Then, if the young birds are put on to the grass land and supplied with plenty of good food, mostly soft, with some grain now and then at nights, there is no reason why they should not thrive, and amply pay back all the time, trouble, and expense when Christmas comes round once more. In conclusion, one should remember that, firstly, the turkey chicks are somewhat delicate, and must, therefore, be kept warm and dry, and they should be shut in if the weather is wet. Secondly, that their crops are extremely small; therefore, their food must be supplied often, and in small quantities. Thirdly, and lastly, that onions, meat, and untiring perseverance are essential to successful turkey raising.

The following article by Mr. W. Lill, an English breeder, was contributed some years ago to the English *Feathered World*, and covers the whole ground of turkey culture :—

Having decided upon the variety of turkeys to keep, the next point is to select the breeding stock. "Breed only from the best" is a rule peculiarly applicable to turkeys, they being wonderfully susceptible to surroundings and influences, anything in the way of poor food, neglect, uncleanness, in-breeding, stale ground, will hinder their growth, and at the same time weaken their constitutions.

Breeding only from the best and most perfect specimens is the only sure way to improve the size and stamina of turkeys—a rule, I fear, which has been greatly neglected, several farmers preferring to sell their earliest and best birds at Christmas for the sake of a little extra price, and often relying on young and immature birds for stock, a custom which invariably ends in failure; and, as a consequence, turkeys have been condemned as being "difficult to rear," &c., when the fault has been the breeder's.

Turkeys will not thrive in confinement; an extensive range is necessary for their welfare. A dry gravelly soil is considered best for turkeys, but from experience I have found not absolutely necessary, a matter of much greater importance being fresh ground.

Turkeys should have a house to roost in apart from other poultry, free from draughts, but with plenty of ventilation. Their natural roosting places being on the branches of trees, therefore warmth is not required; in fact, it is very detrimental to their health, causing them to easier take cold. A house made draught-proof on three sides may with advantage be covered with wire-netting on the south side, thus preventing any over-heating. Their perches should be at least 3 inches broad, with no sharp edges (a larch or other pole, sawn in half, makes an ideal perch). Stock turkeys should not be kept too fat, or soft-shelled eggs will be the result; they will almost get sufficient with the run of a farmyard. If any food is required, nothing is better than oats, with free access, if possible, to turnips or mangels, of the latter of which they are very found. They are naturally good foragers, and this habit should be encouraged, in order to keep them in healthy store condition only.

From five to ten hens are sufficient to mate with one gobbler, and to obtain the best results, I should advise pullets in their first year being mated with a gobbler of his second year, and hens of over one year with a vigorous young cockerel. Pullets of the first year will generally lay a week, or even more, earlier than hens, and also lay a few more eggs before becoming broody; but the chicks from adult hens are stronger and easier to rear. Turkey cocks arrive at maturity after the moult in their third year, after which they are not to be relied upon as stock birds. Turkey hens have been known to lay well for several years, and I strongly advise the keeping of a good hen, when proved satisfactory, as long as she continues profitable, mating her with a young and vigorous gobbler.

I do not recommend a large, and, consequently, heavy gobbler being starved to reduce his weight, a much better plan being to keep him in a separate run, letting him out at intervals, care being taken no harm is done to the hens.

The turkey hen generally prefers choosing her own nesting place, but every inducement should be given her to lay where desired, by preparing suitable places for her, and where she lays her first egg you can rely on finding the succeeding ones with great regularity.

The hen turkey generally lays from fifteen to twenty eggs before becoming broody. It is, therefore, advisable to put about seven of her eggs under a reliable broody hen, when the turkey herself will be able to hatch the remainder, thirteen to fifteen eggs being a nice sitting for her. The nest should be in a quiet, secluded place, where she will not be disturbed, and preferably made upon the ground. Both hens and turkeys are most liable to become covered with lice during incubation. Every effort should be made to destroy and prevent them. If set in a box, it should be well limewashed, and the hens should be dusted with insect powder. A dust bath of good dry ashes, well sprinkled with sulphur, should be provided. The severest war must be waged against the insect pests, as they cause greater mortality amongst the young chicks than all other causes combined. The hen should be fed once a day during incubation, maize, wheat, or barley being suitable, with plenty of grit. A few minutes exercise in a grass-plot is also necessary, failing which greenstuff must be supplied.

The turkey hen, being of a shy disposition, should be interfered with as little as possible, and only by her regular attendant, or she becomes fidgety, and may break her eggs. As a rule she is an excellent sitter, in fact is apt to even starve herself by her persistent sitting, so must be carefully watched to prevent it. In very dry weather it is necessary to damp the surroundings of her nest with a little water. If the hen has set well, the chicks will begin to break the shells on the twenty-eighth day, when the attendant must watch the nest, and remove all empty shells; but if the mother is quiet and docile, the chicks are best left with her until they are a day old,

All the eggs being hatched, and chicks fully a day old, the hen and brood may be put into a large coop outdoors if the day be fine and warm, the mother being well fed, care being taken that the bottom of the coup is both dry and clean, dry ashes, peat moss, cut chaff, or sawdust being supplied, there being no risk of the chicks becoming entangled in these. Their first food may now be given, consisting of hard-boiled egg, chopped up very fine, and mixed with bread crumbs, only giving them a very small quantity, and preferably upon a little feeding board, which can be taken away immediately they have fed, thus preventing any turning sour. The first few days they should be fed every two hours, adding a little green meat finely cut up, dandelion, lettuce, chickweed, or clivers answering admirably. When a few days old a custard can be made, by beating the eggs and boiling in a little new milk until stiff. If too moist, mix with a little grated biscuit to attain the desired consistency

As the chicks get older biscuit meal can be substituted alternately with the custard, and occasionally maize-meal, cooked to a crumbly mass. At all times, from the first few days, an abundance of green food must be supplied, which must be freshly gathered and cut up fine. Onions may be given occasionally, but, as they have a tendency to cause diarrhœa, must be used sparingly; still, as a change, are desirable. During the first few weeks of their existence they require constant attention, their food varying as much as possible, never going with the same kind twice together, their coops and feeding-boards kept scrupulously clean. They must be kept dry and warm, a sudden shower often killing several.

The next section will deal with Turkey Breeding in America.

(To be continued.)

Exports and Cold Storage.

H. V. JACKSON.

It is estimated that the quantity of rabbits and hares packed and frozen in New South Wales during the year ending 31st December, 1909, were as follows:—

	Rabbits. Crates.	Hares. Crates.
January to June	352,570	388
July to December	220,490	1,834
Total	573,060	2,222

The quantity packed may, therefore, be stated at 13,753,440 single rabbits and 26,664 single hares, being an increase on the previous year of 2,567,184 single rabbits and a decrease of 2,316 hares.

The quantity of rabbits and hares exported were 7,172,150 pairs, valued at £329,020; being an increase on the previous year of 1,461,830 pairs, and an increase in the value of rabbits and hares exported of £81,766.

The rabbit and hare skins exported amounted to 3,135,800 lb., valued at £160,372, showing an increase on the previous year in value of £21,285.

The value of rabbits and hares frozen, and of rabbit and hare skins, totalled £489,392.

Rabbit packing and freezing was carried on for a short period during the winter months at works in Sydney as under:—

The Fresh Food and Ice Co., Limited, Darling Harbour.
Burt & Co., Limited, Pyrmont.
Sydney Ice Skating Rink and Cold Storage Co., Limited.
The Metropolitan Ice and Cold Storage Co., Limited.

Work was more or less continuous at the works in the country as follows:—

The Country Freezing Co., Limited, Dubbo.
" " " Warrigal.
" " " Blayney.
" " " Young.
" " " Tibbereenah.
" " " Gunnedah.
Bungendore Freezing Co., Limited, Bungendore.
Crookwell Refrigerating Co., Crookwell.
W. White, Tumut.
Wilson & Flood, Bathurst.
" " Narrandera.
Narrabri Co-operative Dairy Co., Narrabri.
Braidwood Freezing Co., Limited, Braidwood.
J. G. Rohr, Wagga.
J. Moore, Orange.

Works are being constructed at Cootamundra by Mr. W. White, but up to 31st December, 1909, fifteen freezing establishments were in operation in country districts, making a total, with the Sydney establishments, of nineteen works in New South Wales where rabbits and hares are packed and frozen for export.

Permits were issued under the Commonwealth Commerce Act covering goods for shipment, as under:—

	1909. Jan. to June. Package.	1909. July to Dec. Package.	Total.
Canned fruit	3,383	2,861	6,244
Fruit	37,622	115,466	153,088
Hares (crates)...	322	2,161	2,483
Honey	92	24	116
Jam	2,127	3,529	5,656
Leather	4,773	6,936	11,709
Maize	67	149	216
Millet	209	57	266
Plants	393	437	830
Potatoes	27,142	9,078	36,220
Rabbits (crates)	272,935	321,312	594,247
Seeds	3,830	2,549	6,379
	352,895	464,559	817,454

Some exports oversea during 1909.

	Quantity.	Value. £
Horses	1,553	47,473
Butter	17,994,483 lb.	780,008
Fruit (fresh)	56,286 centals	46,609
Wheat	1,913,052 ,,	684,901
Flour	433,151 ,,	231,227
Beef	1,022,164 lb.	11,946
Mutton and lamb	56,384,554 lb.	551,796
Rabbits and hares	7,172,148 pairs	329,020
Meat (preserved)	13,737,015 lb.	250,780
Hides	275,487	261,380
Sheepskins	3,680,847	395,674
Rabbit and hare skins... ...	3,135,800 lb.	160,372
Other skins	....	441,608
Tallow	530,667 cwt.	697,566
Timber	....	259,096
Wine	45,063 gals.	14,402
Wool	293,248,271 lb	12,206,984

The Commonwealth Quarantine Act came into operation on 1st July, 1909, being administered by State officials on behalf of the Commonwealth Government.

The quantity of produce inspected under the Quarantine Act Regulations (Plants) during the six months ending 31st December, 1909, was as follows:—

Quarantine Act - "Plants."

Totals.

Period.	—	Bananas.	Pines and Bananas.	Fruit.	Cereals, &c	Pulses, Vegetables, Bulbs, &c.	Nuts.	Growing Plants.
1909. July to December		*bunches.*	*cases.*	*bushels.*	*tons cwt.*	*tons cwt.*	*½ cwt.*	*cwt.*
	Passed ..	255,604	11,783	56,765	12,635 8	808 8	14,748	189
	Quarantined	nil	nil	11,126	9 0	nil	nil	9

The public are slowly ascertaining the requirements of the Quarantine Department in respect of the limitations which are placed upon the introduction of certain plants, and of the actual prohibition in some instances; but, notwithstanding that the Act has been in operation for some months, and every effort has been made to draw the attention of people interested to the Regulations, and so avoid delays or loss on the part of the public, there are still persons importing some plants occasionally which are of necessity quarantined and have to be destroyed.

Attention is called to the fact that the importation of stone-fruit trees from North America, also pear-trees, is absolutely prohibited. Potatoes can only be introduced under certain stringent conditions, and subject to the approval of the Federal Quarantine authorities.

POULTRY EXPORTS AND IMPORTS.

Return showing the Imports and Interstate transfers into the State of New South Wales of Live Poultry, Frozen Poultry, and Eggs in Shell, during the year 1909; obtained by the courtesy of the Collector of Customs.

Live Poultry.

Imported from	Quantity. No.	Value. £
Interstate—		
Victoria	347	75
Queensland	175	116
South Australia	39,468	3,435
Tasmania	27	8
Oversea—		
New Zealand	12	13
United Kingdom	11	26
Canada	23	45
Norfolk Island	3	3
Japan	10	2
Total	40,076	£3,723

Frozen Poultry.

	lb.	£
Interstate—		
Victoria	14,509	565
Queensland	1,470	41
South Australia	373	13
Oversea—	......	......
Total	16,352	£619

Eggs in Shell.

	Dozens.	£
Interstate—		
Victoria	10,320	522
Queensland	147,300	5,504
South Australia	855,812	37,555
Tasmania	43	2
Oversea—		
Hong Kong	10,288	255
Total	1,023,763	£43,838

RETURN showing the Exports of Live Poultry, Frozen Poultry, and Eggs in Shell from the State of New South Wales during the year ended 31st December, 1909.

Destination.	Poultry.						Poultry—Frozen.				Eggs in Shell.					
	Ordinary.		Breeding Purposes.													
	N.S.W.		N.S.W.		Australian Produce.		N.S.W.		Australian Produce.		N.S.W.		Australian Produce.		Foreign.	
	No.	£	No.	£	No.	£	Pairs.	£	Pairs.	£	Doz.	£	Doz.	£	Doz.	£
India	14	14	3	2	...	...	...	...	...	...	...	...	...	...	...	...
Marshall Islands	168	35	...	...	...	...	...	...	...	...	1,217	101	...	...	...	...
British New Guinea	144	42	11	13	...	...	...	...	...	...	90	5	...	...	...	...
New Hebrides	83	24	13	16	...	...	...	...	...	...	11	1	...	...	...	...
South Sea Islands	136	41	21	45	...	...	...	...	...	...	329	19	...	...	168	7
Neu Pommern	95	29	...	...	...	...	109	16	...	...	386	29	...	...	...	...
Fiji	420	125	25	28	...	...	...	...	...	...	324	21	...	...	...	...
Kaiser Wilhelmsland	23	8	...	...	...	...	...	...	...	...	15	1	...	...	...	...
Philippine Islands	196	86	...	...	...	...	1,027	802	177	141	...	...	...	...	...	...
New Zealand	18	6	35	38	31	37	...	...	...	...	35	36	635	20	...	...
Ocean Island	199	43	...	...	...	...	...	...	...	...	925	80	...	...	...	...
New Caledonia	14	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hong Kong	13	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Straits Settlements	40	25	...	...	...	...	637	196	...	...	...	...	...	...	...	...
Fanning Island	36	17	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Caroline Island	6	1	...	...	...	...	...	...	...	...	108	9	...	...	...	...
Cape Colony	...	...	...	...	...	...	102	28	...	...	...	...	...	...	...	...
Natal	...	...	...	...	...	...	96	26	...	...	...	...	...	...	...	...
Total	1,605	509	108	142	31	37	1,971	1,068	177	141	3,440	302	635	20	168	7

Eggs held in Cold Storage.

It is estimated that slightly over 9,000 cases of eggs in shell were held in Cool Stores.

The following are the figures for the past twelve years:—

1898...	... 11,000 dozen.	1904-5...	... 253,908 dozen.
1899...	... 93,000 „	1905-6...	... 288,648 „
1900...	... 96,000 „	1906-7...	... 150,322 „
1901...	... 140,292 „	1907-8...	... 250,000 „
1902-3	... 130,524 „	1908-9...	... 305,044 „
1903-4	... 151,128 „	1909-10	... 329,976 „

Statement of the Outward Transfers of Poultry and Eggs from New South Wales during the year 1909.

New South Wales.

—	Quantity.			Value.		
	Australian.	Other.	Total.	Australian.	Other.	Total.
Poultry—Frozen.						
	lb.	lb.	lb.	£	£	£
To Victoria ...	1,761	1,300	3,061	168	50	218
West Australia	1,344	......	1,344	45	......	45
Total ...	3,105	1,300	4,405	213	50	263
Poultry—Living.						
	No.		No.	£		£
To Victoria ...	475	......	475	302	......	302
Queensland ...	759	......	759	441	......	441
South Australia	1	......	1	1	......	1
West Australia	23	......	23	24	......	24
Tasmania ...	50	......	50	30	......	30
Total ...	1,308	......	1,308	798	......	798
Eggs.						
	doz.	doz.	doz.	£	£	£
To Victoria ...	12,179	......	12,179	550	......	550
Queensland ...	......	24	24	.....	2	2
South Australia	1,300	24	1,324	95	1	96
West Australia	25	......	25	10	......	10
Tasmania ...	6,812	......	6,812	247	......	247
Total ...	20,316	48	20,364	902	3	905

Donations to the Hawkesbury Agricultural College and the "Farrer Fund."

During his recent visit to the Hawkesbury Agricultural College on Diploma Day, Sir James R. Fairfax was very much impressed with the great value to the State of such an institution, and the excellence of the scientific and practical education given to the students. As a mark of his appreciation he has denoted an amount of £125 to be invested, the interest from which is to form a prize to be known as the "Fairfax Prize," which will be awarded annually to the Dux of the College.

The Minister of Agriculture, in acknowledging Sir James Fairfax's generosity, also desires to acknowledge the receipt of £25 from the same donor towards the "Farrer" Memorial Fund.

Contributions to the Farrer Memorial Fund.

Name.	Address.	Amount. £	s.	d.
Amount received up to 21st April, 1910		358	11	4
His Excellency the Governor		10	10	0
Mr. C. H. Barton, M.P.	Wellington	5	0	0
F. and S. Association	Condobolin	2	2	6
J. L.	Little Plain, Inverell	0	10	0
Mulholland Bros.	Oura, Wagga	5	0	0
Mr. Fredk. Coleman	Saddleworth, S. Aust.	5	5	6
Mr. E. O. T. Bowman	Upper Manilla	0	10	6
Mr. W. J. Parker	Germanton	0	10	6
Mr. F. W. C. Warner	Hallsville, Tamworth	1	1	0
Mr. R. H. Ducker	Sydney	1	1	0
Mr. W. T. Nixon	Department of Agriculture	1	1	0
Mr. Alban Gee	Sydney Meat Preserving Co., Auburn.	1	1	0
Mr. H. M Somer	Secretary, R.A.S.	0	10	0
Mr. C. B. Gaden	Wellington	1	0	0
Mr. S. Whitmee	Spring Hill	1	0	0
Messrs. McLeod & Co.	Wellington	3	3	0
Clyde Engineering Co. (Limited)	Clyde	5	5	0
Collected at Hawkesbury Agricultural College on Diploma Day :—				
Sir James Fairfax	*Sydney Morning Herald*	25	0	0
The Rev. A. A. Aspinall	Bellevue Hill	5	5	0
The Hon. Dugald Thomson	Kirribilli Point, Sydney	3	3	0
Mrs. A. R. Lysaght	Homebush	1	1	0
The Hon. J. A. Gunn, M.L.C.	Wagga	1	1	0
Mr. T. H. Flere		1	0	0
Mrs. J. Sainty		0	10	0
Mr. A. F. Jacob		0	10	0
Mr. P. Lamerand		0	10	0
Mr. R. Hessenbruch		0	10	0
Dr. R. Paton		0	10	0
Mr. Scott		0	10	0
Mrs. Cordingley		0	10	6
Sundry small amounts		2	2	6
Mrs. Bateman	Ravensthorpe, Albion Park	0	10	6
Mr. H. H. Rawson	Talgai, Bogan Gate	5	0	0
A. and P. Association	Ganmain	21	7	0
F. and S. Association	Collie Branch (Trangie)	1	1	6
Dalton Bros.	Orange	5	5	0
Jas. Stedman (Limited)	Sydney	25	0	0
Prof. R. D. Watt	Sydney University	2	2	0
F. and S. Association	Delungra	1	1	0
Mr. W. G. Murray	Oakwood	0	10	0
Total amount received up to 23rd May, 1910		£507	2	4

Irish Blight in Potatoes.

The autumn has brought a recrudescence of the fungus *Phytophthora infestans*, and up to the present time it has been reported as infecting potato crops right through the coastal districts.

The nature of the disease is now pretty well known, but unfortunately no remedial measures are practicable with a fungus pest of this description. Prevention of infection is the only way to avoid loss. Every care should be taken to avoid planting infested seed, and infected plants and tubers should be at once dug up and burnt. The remaining plants should be sprayed with Bordeaux Mixture, special care being taken to cover the under sides of the leaves; and spraying must be repeated as often as is necessary to keep the whole plant covered with fungicide, and protect newly-formed foliage.

Farmers' Bulletin, No. 31, entitled "Certain Fungoid Diseases of Potatoes (including Irish Blight)," by Dr. F. Tidswell, Director of the Bureau of Microbiology, and Mr. T. Harvey Johnston, Assistant Microbiologist, gives full information as to the life-history of *Phytophthora infestans*, and will be sent free to potato-growers on application to the Under Secretary, Department of Agriculture. Demonstrations are now being conducted in the Hunter District, under the direction of Mr. W. J. Allen, with a specially constructed spraying machine for treating potato crops with Bordeaux Mixture. Growers are earnestly urged to make timely preparations for spraying the spring crops directly the first sign of the disease shall have made its unwelcome appearance.

Phalaris commutata and *P. cœrulescens.*

The *Index Kewensis*, published by the Royal Gardens at Kew, says that these two names are synonymous terms for the same grass; but there would appear to be considerable differences between the grasses locally known by these names.

Last year a packet of seed of *Phalaris cœrulescens* was sent to the Glen Innes Experiment Farm for trial. Mr. R. H. Gennys, Manager of the Farm, planted it in rows with the grass *Phalaris commutata* alongside, for comparison. Mr. Gennys reports that although the heads were a good deal alike, the habits of the two grasses were dissimilar. The colours of the leaves were different, and *P. commutata* stooled much more and was later than the other; it was also more procumbent than *P. cœrulescens.* Mr. Gennys cannot say yet whether *Phalaris cœrulescens* will prove perennial; but after one year's trial he finds that *Phalaris commutata* has shown itself much superior to *Phalaris cœrulescens.* Their later growth still shows much dissimilarity.

At the Hawkesbury Agricultural College, *P. cœrulescens* was procumbent, dwarfish, and died away during the hot, dry weather; whilst *P. commutata* in comparison was upright, tall, and survived the dry weather.

It would seem, therefore, that even if the two grasses are merely forms of the same species, there may be an economic advantage in planting *P. commutata.* The Department will be glad if Farm Managers and other growers will observe the two grasses and submit specimens in seed, pulled up by the roots, for examination.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th ...	Wollongbar Farm	†
,, ...	March Pansy ...	Earl March ...	Australian Pansy	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd	Berry Farm ...	*
Jersey ...	Thessalian II ...	Thessalian ...	Egyptian Princess	Wagga Exp. Farm	*
,, ...	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm ...	*
,, ...	Golden Lord ...	Golden King ...	Colleen ..	Wagga Exp. Farm	*
Guernsey ...	Gentle Prince ...	Rose Prince ...	Gentle ...	Rous Mill... ...	5 Sept., '10.
,, ...	The King's Mirror	Calm Prince ...	Vivid (imp.)...	Cumbalum ...	10 Oct., '10.
,, ...	Prince Edward..	Rose Prince ...	Vivid ...	....	24 Nov., '10.
,, ..	Star Prince ...	Calm Prince ...	Vivid ...	Dunoon	3 July, '10.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir ...	South Woodburn..	21 Sept., '10.
,, ...	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Alstonville ...	20 Aug., '10.
,, ...	Claudius ...	Golden Star II..	Claudia's Pride.	H.A College, Richmond	*
,, ...	King of the Roses	Hayes' King ...	Rose 8th ...	Berry Farm ...	*
,, ..	Parson's Hope	Clatford Hope 2nd	Parson's Red Rose 2nd.	Wollongbar Farm.	*
Red Poll ...	The Judge ..	Barrister ..	Lovely 8th ...	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General... ...	Judy 9th ...	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ..	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower	Berry Farm ...	*
,, .	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ..	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ..	Dan of the Roses	Daniel of Auchenbrain	Ripple Rose...	H.A. College, Richmond	*
Kerry... ..	Kildare II ..	Kildare (imp.) .	Belvedere Bratha 3rd.	,, ,,	*
,, ...	Bratha's Boy ...	Aicme Chin ...	Bratha 4th ..	,, ,,	*
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Dexter Kerry	Waterville Punch.	....	.. ..	Grafton Farm ...	*
Holstein ...	Hollander ...	Bosch III ..	Margaretha ...	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 2nd June, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

HOLSTEINS.—Maastricht: sire, Obbe II; dam, Lady Margaret; calved 26th June, 1908; price, £15.

Count Wittereen: sire, Obbe II; dam, Lolkje Zuyder Zee; calved 27th November, 1908; price, £15.

HAWKESBURY AGRICULTURAL COLLEGE.

AYRSHIRES.—*Dado: sire, Daniel of Auchenbrain (imp.); dam, Dot, by Hover of Southwick (imp.), from Flirt, by Heir of Randwick (imp.), from Lady of Randwick; calved 23rd March, 1904; colour, white and brown; price, £20.

***Emerald's Mischief:** sire, Prince Emerald (imp.); dam, Miss Prim, by Mischiefmaker of Barcheskie (imp.), from Primrose of Barcheskie (imp.), by Royal Stuart of Glenbuck, from Lindsay 7th of Barcheskie; calved 4th August, 1903; colour, white and red; price, £30.

WOLLONGBAR EXPERIMENT FARM.

GUERNSEY.—Admiral du Preel: sire, The Admiral; dam, Hayes' Lily du Preel IV (imp.), 6903, from Hayes' Lily du Preel III, 6166, by Hayes' Royal, 1674; calved 4th April, 1909; colour, lemon and white; price, £45.

HOLSTEIN.—De Wet: No. 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909; price, £10.

The prices indicated are at the places named, or on rail.

H. C. L. ANDERSON,
Under Secretary.

* Applications for these bulls will be held till 21st June. If more than one application be received for any one bull, his disposal will be decided by ballot.

Orchard Notes.

W. J. ALLEN.

JUNE.

IN large orchards pruning may be commenced this month, otherwise there is no hurry until July. This important work should not be neglected if growers wish to get the best results. Judicious summer pruning combined with proper winter pruning will repay the grower handsomely for the labour incurred.

Do not forget to cut all trees hard back at time of planting. Refills in all deciduous orchards should be planted not later than the beginning of this month.

Many orchards would be greatly benefited by the application of lime, and the present is a very good time to apply same, so that it will have had time to act upon the soil before the spring manuring. Mark all weak and diseased trees when pruning so that these can receive special treatment. Leave all grapes to be pruned later. Attention should be given to fences, buildings, &c.

Busy time beginning for citrus growers. Main crop oranges and lemons ready for picking.

Where new deciduous orchards are to be planted, the ground, if not already in condition to receive the trees, should be brought to a proper state as early as possible, so that planting may be proceeded with towards the end of the month, or early in July. If fruit trees are not ordered, no time should be lost in placing the order with a reliable nurseryman. Where refills are required, the holes may be dug and allowed to remain open for a time, in order to help to sweeten the soil. They may be planted any time this month.

Stake out any land intended to be planted, and have all deciduous trees delivered early in order to be ready for planting.

Export of Apples Grown in the County of Cumberland.

It has for many years been a common idea that apples grown on the warm coastal area of the State will not carry well. Some modification of this opinion is rendered necessary by the results of an experimental shipment made to London this season by Mr. C. Churchill Tucker, as reported in the daily Press. The varieties shipped were Jonathan, Cleopatra, Granny Smith, Aitken, and Trivett's Seedling. These were packed and forwarded to the purser of an outgoing mail boat, who carried the fruit in the ship's cold store. Mr. Tucker has now received a report from Mr. T. J. Poupart, fruit salesman, Covent Gardens, to the effect that the Aitken arrived in good condition, the only signs of waste being in the Granny Smith, which had one rotten on top, and the Trivett Seedling, which had two rotten. The Jonathan, Granny

Smith, and Cleopatra all showed more or less bitter pit and spot, but the Aitken and Trivett were immune from this scourge, and arrived perfectly sound.

As many of the Cumberland growers are turning their attention to apple-growing, the result of this experiment is valuable, indicating that some early varieties of apples, grown in the coastal districts, can be successfully carried to England, and placed on the market at a very favourable time.

Mr. Tucker did not say whether or not the Cleopatra, Jonathan, and Granny Smith were taken from young or old trees. If they were taken from young trees they could not be expected to carry as well as fruit from old trees. I feel confident that Granny Smith, and, perhaps, Jonathan, apples will be found to carry well as soon as the trees from which the fruit is taken have borne a few crops; provided they are picked at the right time, and, of course, handled and packed properly.

Apples in Cooma District.

Mr. Jacob Feilen, of Greendale, Cooma, has supplied me with specimens of the undermentioned apples, grown by him, with the notes following the name of each variety.

They were a fine lot of specimens, and stand as an object lesson of what can be produced in that part of our southern highlands. Fruit-trees in this district should never be planted in gullies or along river flats, but in elevated situations where they usually escape late frosts.

Jonathan.—Picked early in March; tree doing well, and a good bearer.

Rome Beauty.—Doing well; one of the best for this district.

White Winter Permain.—Good grower, constant and heavy bearer, very free from disease, rich flavour; one of the best for this district, and keeps until September.

Five Crown Pippin.—Not a desirable variety here.

Esopus Spitzenberg.—Trees six years old; had a good crop during last two seasons; tree a good grower, fruit seems to shrivel when stored a few weeks; splendid dessert apple.

Green Newtown Pippin.—Splendid variety here; good keeper, aromatic flavour; tree good grower.

Granny Smith.—Splendid variety, good keeper; tree vigorous grower.

Stone Pippin.—Good bearer and keeper.

Cleopatra.—Tree vigorous, good bearer; fruit subject to mouldy core.

Dougherty.—A new variety here; tree five years old; had a good crop this season; tree good grower.

Buncombe.—Same remarks.

Large Quince from Henty.

Some time ago a note appeared in the Press drawing attention to some particularly fine quinces which had been grown at Pilliga Scrub, and it was remarked at the time that one of the specimens was the finest I had seen this season. Since then, however, I have received from Mr. A. Rosler, of Henty, a quince of the same variety as those from Pilliga, viz., "Missouri Mammoth," which as regards size beats the Pilliga specimen, the weight being $2\frac{3}{4}$ lb., or 4 oz. heavier than that previously noted.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Brewarrina P. and A. Association	H. L. Cathie ...	June 1, 2
Lachlan P. and A. Association (Hillston)	S. G. Gordon ...	July 21
Deniliquin P. and A. Society	L. Harrison ...	,, 21, 22
Hay P. and A. Association	G. S. Camden ...	,, 26, 27
Riverina P. and A. Society (Jerilderie)	W. Elliott ...	,, 26, 27
Balranald P. and A. Society	A. Malcolm ...	,, 27
Narrandera P. and A. Association	W. T. Lynch ...	Aug. 3, 4
Corowa P., A., and H. Society...	J. D. Fraser ...	,, 16, 17
Coolamon A. and P. Association	J. W. Skien ...	,, 17
Forbes P., A., and H. Association	H. J. Brooke ...	,, 17, 18
Gunnedah P., A., and H. Association...	M. C. Tweedie ...	,, 23, 24, 25
Murrumbidgee P. and A. Association	A. F. D. White ...	,, 23, 24, 25
Parkes P., A., and H. Association	G. W. Seaborn ...	,, 24, 25
Grenfell P., A., H., and I. Association	Geo. Cousins ...	,, 30, 31
Wyalong District P., A., H., and I. Association ...	T. A. Smith ...	,, 30, 31
Junee P., A., and I. Association	T. C. Humphrys...	,, 31, Sept. 1
Young P. and A. Association	G. S. Whiteman...	Sept. 6, 7, 8
Ariah Park P., A., H., and I. Association	A. T. White ...	,, 7
Germanton P., A., and H. Society	J. S. Stewart ...	,, 7, 8
Albury and Border P., A., and H. Society	W. I. Johnson ...	,, 13, 14, 15
Ganmain A. and P. Association	J. H. Ashwood ...	,, 14
Northern A. Association (Singleton)	H. A. Bennett ...	,, 14, 15, 16
Cootamundra A., P., H., and I. Association... ...	T. Williams ...	,, 15, 16
Temora P., A., H., and I. Association	John Clark ...	,, 20, 21, 22
Mullumbimby A. Society	N. Neilsen ...	Nov. 9, 10
Lismore A. and I. Society	T. M. Hewitt ...	,, 16, 17, 18

1911.

Society.	Secretary.	Date.
Kiama A. Association	R. Somerville ...	Jan. 25, 26
Alstonville A. Society	W. W. Monaghan	Feb. 8, 9
Shoalhaven A. and H. Association (Nowra) ...	H. Ranch ...	,, 15, 16
Kangaroo Valley A. and H. Association	J. Moffit	,, 23, 24
Inverell P. and A. Association	J. McIlveen ...	,, 28, Mar. 1, 2, 3
Tenterfield P., A., and M. Society	F. W Hoskin ...	Mar. 7–11
Central New England P. and A. Association (Glen Innes)	G. A. Priest ..	,, 14, 15, 16
Bellinger River A. Association (Bellingen)	S. S. Hindmarsh	,, 15, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 16, 17, 18
Luddenham A. and H. Society...	W. Booth ...	,, 21, 22
Yass P. and A. Association	W. Thomson ...	,, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 5, 6
Dungog A. and H. Association	C. E. Grant ...	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 5, 6, 7
Bathurst A., H., and P. Association	A. H. Newsham ..	,, 26, 27, 28

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E. R. No. 308

DEPARTMENT OF AGRICULTURE, NEW SOUTH WALES.

Certificate of Soundness and Approval

Issued for LIFE.

Given in respect of the Thoroughbred Stallion Sir Amyer Dark Chestnut, blaze, 16.1 near hind leg & off fore pastern white 5 years submitted for Government Inspection by the Owner. Mr. S. H. Hoskisson at Hawkesbury Parade such horse having been found suitable for Stud Service and free from hereditary unsoundness and defects of conformation predisposing thereto on examination by C. J. Sanderson M.R.C.V.S., Veterinary Officer, on the Eighteenth day of February 1910.

Issued by direction of the Minister for Agriculture.

[illegible]
Under Secretary for Agriculture.

S. T. D. Symons. M.R.C.V.S.
Chief Veterinary Officer.

Agricultural Gazette of New South Wales.

Examination as to Soundness, and Certification of Stallions.

FIRST REPORT ON THE WORKING OF THE GOVERNMENT SCHEME.

S. T. D. SYMONS, M R.C.V.S., Chief Veterinary Officer, and Chief Inspector of Stock, N S.W.

ALTHOUGH both prior and subsequent to the year 1894 various references as to the necessity for Government action in connection with the improvement of the breeding of horses have been made in the annual reports of the Stock and Brands Branch of the Department of Agriculture, in that year the late Alexander Bruce, Esq., Chief Inspector of Stock, wrote as follows:—

> A tax on stallions is still advocated by a large number of breeders, and is, I think, desirable, at any rate in cases where they stand for mares other than those belonging to the owners of the horses, and in all such cases the horses should be subjected to inspection by a qualified veterinary surgeon appointed by the Government, and certified to as sound and free from disease. It is also recommended that all entires be registered.

In the year 1902 a draft of a measure was prepared, entitled "A Bill imposing a tax on Stallions and to professionally examine Stallions for Disease or Defect," but, as far as I am aware, this Bill was never even presented to Parliament.

Several conferences of horse-breeders have also been held at various times, but without any practical results ensuing.

The neighbouring State of Victoria took action in the year 1907 in the matter of inaugurating a system of "Veterinary Inspection of Stallions for Government Certificate of Soundness and Approval," this being accomplished without any particular legislation. On account, however, of non-certificated horses being still allowed to compete at shows there, it was found necessary the following year to restrict the subsidies granted to Agricultural Societies unless it was provided for in their rules that a Government certificate of soundness and approval should have been issued in respect of all stallions 3 years old or over competing for prizes at the shows held by the societies.

Although various Governments of this State have for long recognised that a general improvement in horse-breeding was not likely to be effected by the unaided efforts of Agricultural Societies and breeders, it is only comparatively recently, and during the period of office of the present Minister for Agriculture, the Honorable John Perry, that any effective action in furtherance of the project has been taken.

As before remarked, the Victorian measure was not the result of any special legislation, nor did it make it compulsory on horse-owners to submit their horses for examination. Apart from the condition that horses competing at subsidised agricultural shows should be certificated, it otherwise

remained voluntary with horse-owners as to whether they submitted their horses or not. However, the undertaking in practice was found to work so well that the majority of stallions in that State were submitted for examination, and stallion-owners soon came to recognise the great advantage of having the Government approval, breeders being almost unanimous in demanding the production of the certificate in regard to horses travelling for stud duty.

The New South Wales scheme can only be looked upon as being more or less imperfect as yet, but it has, as a preliminary, awakened broad discussion on the subject of soundness in horses amongst breeders and the horse-owning public generally, and can be looked upon as paving the way to a more advanced and comprehensive measure, to be effected by legislation if necessary, within the near future.

Regulations governing the New South Wales scheme were published in September, 1909, and recognising the importance that in States adjoining the conditions should be as similar as possible, our regulations were largely based on those of Victoria, which had been found in practice, covering three seasons, to work satisfactorily.

That State, however, commenced by issuing life certificates to all animals presented during the first year, but it was thought to be advantageous to commence here by issuing life certificates only to stallions 5 years old and over, 3 and 4 year old animals being certificated for the season only.

On account of numerous unavoidable delays in the appointment of veterinary officers, it was too late in the season of 1909 to arrange for a series of parades for the examination and certification of horses before they started to travel in their usual districts, so, under the instructions of the Minister for Agriculture, it was decided to make a commencement by carrying out the examinations at as many of the Agricultural Shows as possible.

The whole of the Agricultural Societies were circularised, outlining action as proposed, and they were also furnished with copies of the regulations, and, although several of them omitted to reply at the time, nearly all of these societies did so subsequently, expressing decided approval therewith, and promising to render every assistance to further the scheme. Their later action has clearly demonstrated a desire to assist the Department very thoroughly.

Included in the regulations is an arrangement which has been entered into with the New Zealand Government to accept certificates issued by the New Zealand Veterinary Department in respect of stallions exported to New South Wales. These certificates are, on arrival, exchanged for the New South Wales Government certificate without further examination. This arrangement should prove of great service to importers, as, if availed of by them, it precludes the possibility of importing horses which would be refused a certificate here.

The same procedure obtains with respect to certificates issued by the Queensland and Victorian Governments. The veterinary certificates of the Royal Shire Horse Society (England), the Royal Agricultural Society

(England), the Royal Dublin Society's Horse Show (Ireland), the Highland and Agricultural Society (Scotland), and the Glasgow and West of Scotland Agricultural Society are accepted with respect to importations from the United Kingdom.

In the following table is set out the number of horses examined since the inception of the scheme up to and including 31st March, 1910. The numbers of each class and the causes for the rejections are also included.

Analysis of Defects of Stallions refused Certificates to 31st March, 1910.

Defects	Draughts. Examined. 240	Passed. 142	Lights Examined 247	Passed. 215	Ponies. Examined. 217	Passed. 153	Totals. Examined. 659	Passed. 510
	Rejected	Per-centage Rejected.	Rejected	Per-centage Rejected.	Rejected.	Per centage. Rejected	Rejected.	Per-centage Rejected.
1. *Unsoundness*—								
Sidebone	67	27 91	2	0·80	......	....	69	10·47
Ringbone... .	8	3·33	12	4·80	1	0·58	21	3·18
Bone Spavin ...	4	1·66	8	3 20	1	0 58	13	1·97
Bog Spavin and Thoroughpin.	8	3 33	1	0·40	1	0 58	10	1·51
Curb	.....	.. ...	2	0·80	1	0·58	3	0·45
Roarer	3	1 25	1	0 40	.....	......	4	0·60
	90	37·50	26	10 55	4	2·32	120	18·21
2. *Below Standard*—	8	3·33	6	2·40	15	8·72	29	4·40
Grand Totals ...	98	40·83	32	12·95	19	11·04	149	22 61

As will be seen by the foregoing table, a good beginning has been made, but examination at shows is not very satisfactory for many reasons, and the system of stallion parades arranged for next season will certainly prove better in every respect.

The initiation of the certification scheme has not escaped criticism, both from the Press and from the general public. As a rule, such criticism has been favourable to the scheme as a whole, although a very great number of critics consider it not far-reaching enough, and assert that it should provide for the unsexing of rejected stallions, or the imposing of a very heavy annual tax on all sires that fail to pass the Government examination.

In connection with this latter suggestion, it is of interest to note that at a conference of delegates from Agricultural Societies, convened by the Royal Agricultural Society of New South Wales in March of this year, to discuss a proposed tax on stallions, all proposals submitted to that end were rejected, and the resolutions actually carried were as follow:—

1. That a veterinary examination be held at stated periods in each district of all stallions 3 years and upwards, and that such examination be free of cost.
2. That all stallions standing for public service be examined, and that a Government report on each stallion be advertised with the notice of the horse standing for fees.

It will thus be seen that the Government scheme pretty accurately represents the lengths to which the majority of horse-breeders in the State are prepared to go.

It may be contended that such a universal opinion, to the effect that steps should be taken to improve the breed of horses, could not have arisen unless the condition of the horse-breeding industry was such as called for some immediate action. Even if this be admitted, the Government is not in possession of authentic information which would warrant them in proposing too drastic measures at the present time for the improvement of the industry. When the next stallion examination season has been completed certain information will then be at the disposal of the Minister for Agriculture, which will show the actual state of affairs, and the knowledge thus gained may result in an amendment of the regulations.

The putting into force of the present regulations has had a great educational influence by directing the attention of breeders and horse-owners generally to the various forms of unsoundness, and to the influence of heredity in their production. It is hoped that the interest now awakened may go further, and direct public attention to a point of equal importance, viz., the paramount importance of breeding from pure-bred sires of undoubted pedigree dating back many generations.

The decision of the Cowra Agricultural and Pastoral Association to obtain a pure-bred sound sire for use in the district is a welcome sign that this association at least is helping in the most practical manner to improve horse-breeding. It is an example that might well be followed by other societies.

The veterinary examination for Government certificate, so far as it has gone, has demonstrated clearly—

1. That the majority of sires in this State are grades;
2. That fresh blood is required in some classes.

Cross-bred horses are not infrequently as fine-looking animals as their pure-bred sires, but the danger to the horse-breeding industry of using them for stud purposes is the undoubted fact that they cannot with any degree of certainty produce their own good qualities. "Like begets like" only when it is backed up by a long line of pure-bred ancestors on both sides, thereby ensuring fixity of type. It would be a misfortune if, in our efforts to improve the breeding of a good sound type of horse, the evil influence of the grade stallion was lost sight of.

It must be acknowledged that the introduction of fresh blood is very desirable in all classes, but the pony class especially is in danger of extinction owing to repeated and injudicious crosses.

Judges at Agricultural Shows throughout the State should see to it that only pure-bred stock are given prizes in pure-bred classes. A conscientious adhesion to this rule would have a great educational influence, and, moreover, it may be considered a duty that they owe to the horse-breeding industry, to the society under whose auspices they act, and to their own reputations.

It is satisfactory to note that at the Sydney horse sales, following the Royal Agricultural Show, buyers generally demanded the production of a

E. R. Interim No. 392/2

DEPARTMENT OF AGRICULTURE, NEW SOUTH WALES.

Certificate of Temporary Approval

FOR THE SEASON 1910

Of the Cob Two-Year Old Colt Retford Login
Bay, black points, 14.1, saddlemarks, very small star, 2 years.
submitted for Government Inspection by the Owner Mr. J. W. Cunningham
at Moss Vale, Parade . such Colt having
been found free from indications of hereditary unsoundness or predisposition thereto on
examination by J. G. Palgrave M.R.C.V.S. Veterinary Officer,
on the third day of March 1910.

Issued by direction of the Minister for Agriculture.

Geo. H. Anderson
Under Secretary for Agriculture.

S. T. D. Symons M.R.C.V.S.
Chief Veterinary Officer.

This Certificate expires on 30th June, 1910.

Government certificate when making purchases. This foreshadows the decreased use of unsound sires.

It is a misfortune that the buyer of pure-bred stock does not possess a better means of detecting "faked" pedigrees than the stud books at present available, as, excepting in the case of thoroughbreds, and latterly trotters, stud books of breeds of horses have not yet been brought into existence, and even those are not availed of to any great extent.

The different forms of certificates are illustrated in connection with this article, and will prove of interest to readers. In regard to that issued for animals 2 years old, it is necessary to explain that they do not embrace any approval for stud duty. They serve only to indicate to the owner that the conformation and freedom from unsoundness of their colts warrants their being retained entire, with a prospective view to stud service.

Stallion Parades, 1910.

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
Metropolitan—				
10, 11, 12, and 13 Aug.	R.A.S. Ground ...	10 a.m. daily.	... ...	... ...
Every Saturday by prior arrangement with Chief Inspector of Stock.	Stock Office, 56 Bridge street.	10 a.m. to 12 noon.	... ...	... ...
Week ending 18 June.				
North Coast, No. 1—				
Thursday, 16 June ...	Murwillumbah ..	11·30 a.m.	11 a.m., 16th ...	3·30 p.m., 16th.
Friday, 17 ,, ..	Mullumbimby ...	10 a.m. ...	4·27 p.m., 16th	4·27 p.m., 17th.
Saturday, 18 ,, ...	Lismore	10 a.m. ...	6·32 p.m., 17th	7·45 a.m., 20th.
Week ending 25 June.				
North Coast, No. 2—				
Monday, 20 June ..	Bangalow ...	10 a.m. ...	8·44 a.m., 20th	12 30 p.m., 20th (driving).
,, 20 ,, ..	Alstonville ...	2·30 p.m. ..	2 p.m., 20th ...	5 p.m., 20th (driving).
Tuesday, 21 ,, ...	Casino	10 a.m. ...	6·10 a.m., 21st	2·30 p.m., 21st.
Wednesday, 22 ,, ...	Kyogle	10 a.m. ...	6·30 p.m., 21st	2·30 p.m., 22nd.
Thursday, 23 ,, ...	Coraki	10 a.m. ...	8 a.m., 23rd ...	2·30 p.m., 23rd (driving).
Western, No. 1—				
Tuesday, 21 June ...	Cudal	10 a.m. ...	8·20 a.m., 21st	3·30 p.m., 21st.
Wednesday, 22 ,, ..	Molong	10 a.m. ...	8·50 p.m., 21st	6·14 a.m., 23rd.
Thursday, 23 ,, ...	Parkes	10 a.m. ...	8·40 a.m., 23rd	9 a.m., 24th.
Friday, 24 ,, ...	Forbes	2 p.m. ...	10 a.m., 24th ...	7·55 a.m., 25th.
Saturday, 25 ,, ..	Bogan Gate ...	11 a.m. ...	10·50 a.m., 25th	11·10 a.m., 27th.
Southern, No. 1—				
Wednesday, 22 June ...	Hay	10 a.m. ...	5·25 p.m., 21st	8·55 a.m., 23rd.
Thursday, 23 ,, ...	Carrathool ..	2 p.m. ...	10·30 a.m., 23rd	10·30 a.m., 24th.
Friday, 24 ,, ...	Narrandera ..	3 p.m. ..	2·27 p.m., 24th	2·53 p.m., 25th.

STALLION PARADES—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
		WEEK ENDING 2 JULY.		
North Coast, No. 3—				
Thursday, 30 June ...	Grafton	2 p.m. ...	1 p.m., 30th ..	9 a m., 1 July (driving).
Saturday, 2 July	Maclean	10 a.m. ...	— 1st	— 3 July.
Western, No. 2—				
Monday, 27 June ...	Condobolin ..	2 p.m. ..	1·50 p.m, 27th .	11·25 a.m., 28th.
Wednesday, 29 June...	Gilgandra	2 p.m. ..	12·9 p.m., 29th..	12·29 p.m., 30th.
Thursday, 30 June ...	Gulargambone . .	2·30 p.m. ..	2·5 p.m., 30th ...	1·43 p.m., 1 July
Friday, 1 July ...	Coonamble ...	3 p.m. ...	2·53 p.m., 1st ...	10 30 a.m., 2nd.
Southern, No. 2—				
Monday, 27 June ...	Coolamon... ...	10 a.m. ...	4·25 p.m., 25th	4·25 p.m., 27th.
Tuesday, 28 ,, ...	Murrumburrah ...	10 a.m. ...	8·40 p.m., 27th	5·40 a.m., 29th.
Wednesday, 29 June...	Young	10 a.m. ...	6·29 a.m., 29th	6·45 a m., 30th.
Thursday, 30 June ...	Grenfell	11 a.m. ,.	10·45 a.m., 30th	2·10 p.m , 30th.
		WEEK ENDING 9 JULY.		
North Coast, No. 4—				
Tuesday, 5 July ...	Coramba	10 a.m. ...	4 p.m., 4th (driving).	1·30 p.m., 5th (driving).
Wednesday, 6 July ...	Bellingen	10 a.m. ...	— 5th (driving)	— 6th (driving).
Thursday, 7 July ...	Bowraville ...	2 p.m. ...	— 6th (driving)	— 8th (driving).
Saturday, 9 ,, ...	Kempsey	10 a.m. ...	— 8th (driving)	8·30 a.m., 11th (driving).
Western, No. 3—				
Tuesday, 5 July ...	Dubbo	10 a.m. ...	9·1 a.m., 5th ...	9·1 a.m., 6th.
Wednesday, 6 July ...	Narromine ...	10 a.m. ...	9·45 a.m., 6th ...	10·30 a m., 7th.
Friday, 8 July ...	Peak Hill... ...	10 a.m. ...	5 p.m., 7th ...	9 a.m., 9th (driving).
Southern, No. 3—				
Thursday, 7 July ...	Jerilderie... ...	10 a.m. ...	3·40 p.m., 6th...	4·15 p.m., 7th.
Friday, 8 July ...	Berrigan	10 a.m. ...	5·25 p.m., 7th...	8·30 a.m., 9th (driving).
		WEEK ENDING 16 JULY.		
North Coast, No. 5—				
Tuesday, 12 July ...	Port Macquarie ...	2 p.m. ...	— 11th (driving)	8·30 a.m., 13th (driving).
Thursday, 14 July ...	Taree	10 a.m. ...	— 13th (driving)	2 p.m., 14th (driving).
Friday, 15 July ...	Wingham... ...	10 a.m. ...	— 14th (driving)	2 p.m., 15th (driving).
Saturday, 16 July ...	Gloucester ...	10 a.m. ..	— 15th (driving)	9 a.m., 18th.
Western, No. 4—				
Monday, 11 July ...	Trangie	11 a.m. ...	10·21 a.m., 11th	10·21 a.m., 12th.
Tuesday, 12 ,, ..	Warren	2 p.m. ...	11·53 a.m., 12th	9·55 a.m., 13th.
Wednesday, 13 July ...	Nyngan	2 p.m. ...	noon, 13th ...	2·40 p.m., 14th.
Southern, No. 4—				
Monday, 11 July ...	Tocumwal ...	10 a.m. ...	— 9th (driving).	4·30 p.m., 11th.
Tuesday, 12 ,, ...	Deniliquin ...	10 a.m. ...	1·30 a.m. (driving).	— 13th (driving)
Thursday, 14 July ..	Moama	10 a.m. ...	— 13th (driving)	4 p.m., 14th.
Friday, 15 July ...	Albury	2 p.m. ...	noon, 15th ...	9·15 a.m., 16th.

STALLION PARADES—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
	Week ending 23 July.			
Northern, No. 1—				
Monday, 18 July ...	Dungog	2·30 p.m. ...	1 p.m., 18th ...	9 a.m., 19th (driving).
Wednesday, 20 July ...	Raymond Terrace..	10 a.m. ...	—19th (driving)	2 p.m., 20th.
Thursday, 21 July ...	Newcastle ...	10 a.m. ...	—20th	3·5 p.m., 21st.
Western, No. 5—				
Wednesday, 20 July ...	Cobar	10 a.m. ...	4·20 p.m , 19th..	10·20 a.m., 21st.
Friday, 22 July ..	At Nyngan ...	——	2·5 p.m., 21st ...	12·25 p.m., 23rd.
Southern, No. 5—				
Tuesday, 19 July ...	Corowa	10 a.m. .	9 20 a.m. ...	12·20 p.m., 20th.
Thursday, 21 July ..	Henty	10 a.m. ..	3·55 p.m., 20th..	7·50 p m., 21st.
Friday, 22 July ...	Germanton ...	9 a.m. ...	8·15 a.m., 22nd..	1·50 p.m., 22nd.
	Week ending 30 July.			
Northern, No. 2—				
Wednesday, 27 July...	West Maitland ..	10 a.m. ..	11·27 p.m., 26th	7·6 p.m., 27th.
Thursday, 28 July ...	Singleton	10 a.m. ...	8·5 p.m., 27th	8·15 p.m., 28th.
Friday, 29 July .	Muswellbrook ...	10 a.m. ...	9·12 p.m., 28th	2·30 a.m., 30th (driving).
Western, No. 6—				
Monday, 25 July ..	Byrock	10 a.m. ...	3·52 p.m., 23rd	3·52 p.m., 26th.
Wednesday, 27 July...	Bourke	10 a m. ...	5·40 p.m., 26th	9·5 a.m., 29th.
Saturday, 30 July ...	Wellington .	10 a.m. ...	7 p.m., 29th ...	7 p.m., 30th.
Southern, No. 6—				
Monday, 25 July ...	Urana	10 a.m. ..	5 p.m., 23rd ...	3 p.m., 25th (driving).
Tuesday, 26 ,, ...	Lockhart	9 a.m. ...	8 p.m., 26th (driving).	2·25 p.m., 26th.
Wednesday, 27 July...	The Rock... ...	10 a.m. ...	4·10 p.m., 26th	4·32 p.m., 27th.
Thursday, 28 July ..	Wagga	10 a.m. ...	5·16 p.m., 27th	5·16 p.m., 29th.
Saturday, 30 ,, ...	Temora	10 a.m. ...	8·45 a.m., 30th	9·40 a.m., 1 Aug.
	Week ending 6 August.			
Northern, No 3—				
Tuesday, 2 August ...	Cassilis	10 a m. ...	3·30 p.m., 30 July (driving)	11 a.m., 3 Aug. (driving).
Thursday, 4 August ..	Denman	10 a.m. ...	8·30 p.m., 3rd (driving).	— 4th (driving).
Friday, 5 August ...	Scone	10 a.m. ..	9·45 p.m., 4th	4·40 p.m., 5th.
Saturday, 6 August ...	Murrurundi ...	10 a.m. ...	5·30 p.m., 5th	11·1 p.m., 6th.
Western, No. 6A—				
Wednesday, 3 August	Brewarrina ..	10 a.m. ...	7·10 p.m., 2nd...	8·10 a.m., 5th.
Saturday, 6 August	Orange	10 a.m. ...	9·45 p.m., 5th	10·52 a.m., 8th.
Southern No. 6A—				
Monday, 1 August ...	Barellan	3 p.m. ...	2 30 p.m., 1st ...	11·35 a.m., 2nd.
Wednesday, 3 August	Wyalong	2 p.m. ...	11 50 a.m. ...	1·15 p.m., 4th.
Friday, 5 August ...	Stockinbingal ...	10 a m. ...	5·41 p.m., 4th	5·51 p.m., 5th.
Saturday, 6 August ...	Cootamundra ...	10 a.m. ...	6 45 p.m., 5th	6·51 a.m., 8th.
	Week ending 13 August.			
Northern, No. 4—				
Friday, 12 August ...	Quirindi	10 a.m. ...	4·7 a.m. ...	6·37 p.m.
Saturday, 13 August ..	Werris Creek ...	10 a.m. ...	7·1 p.m., 12th...	12·20 a.m., 15th.
Western, No. 7—				
Monday, 8 August ...	Milthorpe ...	2 p.m. ...	11·18 a.m. ...	5·54 p.m.
Southern, No. 7—				
Monday, 8 August ...	Junee	10 a.m. ...	8·11 a.m. ...	6·30 p.m.

(And Metropolitan, see page 557.)

STALLION PARADES—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Leaves.
		WEEK ENDING 20 AUGUST.		
Northern, No. 5—				
Monday, 15 August ...	Gunnedah ...	10 a.m. ...	1·45 a.m., 15th	4·30 a.m., 16th (driving).
Wednesday, 17 August	Coonabarabran ...	10 a.m. ...	4·45 p.m., 16th	7 a.m., 19th.
Western, No. 8—				
Wednesday, 17 August	Cowra	10 a.m. ...	6·45 a.m. ...	8 a.m., 18th.
Thursday, 18 August..	Canowindra ...	2 p.m. ...	10·45 a.m. ...	10·30 a.m., 19th.
Saturday, 20 „ ...	Carcoar	10 a.m. ..	8·24 p.m., 19th	8·24 p.m., 20th.
Southern, No. 8—				
Friday, 19 August ..	Gundagai	10 a.m. ...	8·55 a.m ...	9·20 a.m., 22nd.
		WEEK ENDING 27 AUGUST.		
Northern, No. 6—				
Thursday, 25 August...	Walgett	2 p.m. ...	1·30 p.m., 25th	9·5 a.m., 26th.
Saturday, 27 „ ...	Burren Junction..	10 a.m. ...	12 45 p.m., 26th	9·5 a.m., 29th.
Western, No. 9—				
Monday, 22 August ..	Bathurst	10 a.m. ...	10·41 p.m.. 20th	11·30 p.m., 22nd.
Tuesday, 23 „ ...	Oberon	10 a.m. ...	6 a.m., 23rd ...	8 p.m., 23rd.
Wednesday, 24 August	Rylstone	10 a.m. ..	4·49 a.m., 24th	8·47 p.m., 24th.
Southern, No. 9—				
Tuesday, 23 August ..	Tumberumba ..	10 a.m. ..	9·30 p.m., 22nd	4 a.m., 25th.
Friday, 26 August ..	Tumut	9 a.m. ...	— 25th (driving)	1·45 p.m., 26th.
		WEEK ENDING 3 SEPTEMBER.		
Northern, No. 7—				
Monday, 29 August ...	Collarenebri ...	2 p.m. ...	12·45 p.m., 29th	10 a.m., 30th
Wednesday, 31 August	Narrabri	10 a.m. ..	4·50 p.m., 30th	5.35 p.m., 31st.
Thursday, 1 September	Boggabri	10 a.m. ..	6·59 p.m., 31st	6 59 p.m., 1st.
Western, No. 10—				
Tuesday, 30 August ...	Mudgee	10 a.m. ...	6·30 a.m., 30th	6·50 a.m., 31st.
Wednesday, 31 August	Gulgong	10 a.m. ...	8·10 a.m., 31st	8·30 a.m., 1 Sept. (driving)
Thursday, 1 September	Dunedoo	2 p.m. ...	— 1st (driving)	8·30 a.m., 2nd (driving).
Southern, No. 10—				
Tuesday, 30 August ...	Binalong	10 a.m. ...	10·15 p.m., 29th	4·24 a.m., 31st.
Wednesday, 31 August	Burrowa	10 a.m. ...	7·10 a.m., 31st	6 p.m., 31st.
Thursday, 1 September	Yass	11 a.m. ..	10·19 a.m., 1st...	10·15 p.m., 1st.
Friday, 2 September...	Gunning	10 a.m. ...	11·5 p.m., 1st ...	11·29 a.m., 3rd.
		WEEK ENDING 10 SEPTEMBER.		
Northern, No. 8—				
Thursday, 8 Sept. ...	Moree	10 a.m. ...	7·20 a.m., 8th ..	7·45 a.m., 9th.
Friday, 9 September...	Warialda	2 p.m. ..	10·40 a.m., 9th..	11·55 a.m., 10th.
Central, No. 1—				
Monday, 5 September..	Dural	11 a.m. ...	10 a.m., 5th ..	5 p.m., 5th.
Tuesday, 6 September.	Richmond ...	11 a.m. ...	10·45 a.m., 6th..	4 p.m., 6th.
Wednesday, 7 Sept. ...	Penrith	11 a.m. ...	10·30 a.m., 7th..	4 p.m., 7th
Thursday, 8 September	Wollongong ...	2 p.m. ...	10·50 a.m., 8th..	8·30 p.m., 8th.
Friday, 9 September ..	Kiama	10 a.m. ...	9·25 p.m., 9th ..	2·25 p.m., 9th.

E. R. Interim No. 553. 3

DEPARTMENT OF AGRICULTURE, NEW SOUTH WALES.

Certificate of Soundness and Approval

FOR THE SEASON 1910.

Of the Draught Three-Year Old Stallion Butterbone Cupbearer Suffolk Punch 3 years old R 4/6 H near Shoulder, submitted for Government Inspection by the Owners Butterbone Pastoral Co, at Parade, Sydney such Stallion having been found suitable for Stud Service and free from indications of hereditary unsoundness and defects of conformation predisposing thereto on examination by Max Henry MRCVS Veterinary Officer, on the twentyfirst day of March 1910.

Issued by direction of the Minister for Agriculture.

[signature]
Under Secretary for Agriculture.

S. T. D. Symons. MRCVS.
Chief Veterinary Officer.

This Certificate expires on 30th June, 191 , and must be handed to the Veterinary Officer at NEXT ANNUAL Examination.

STALLION PARADES—*continued.*

District and Date.	Place.	Time.	Officer Arrives	Officer Leaves.
	Week ending 10 September—*continued.*			
Southern, No. 11—				
Monday, 5 September..	Goulburn	10 a.m. ...	12·37 p.m., 3rd..	7·20 a.m., 6th.
Tuesday, 6 ,,	Crookwell... ...	11 a.m. ..	10 a m., 6th ..	3 p m., 6th.
Wednesday, 7 Sept. ...	Marulan	2 p.m. ...	1·30 p.m., 7th ..	1·20 a.m., 8th.
Thursday, 8 September	Moss Vale ..	10 a.m. ...	2·27 a.m., 8th ..	3·8 p.m., 8th.
	Week ending 17 September.			
Northern, No. 9—				
Monday, 12 September	Inverell	10 a.m. . .	3·50 p.m., 10th	3·30 p.m., 12th (driving).
Tuesday, 13 September	Bundarra	10 a.m. ...	7 p.m., 12th (driving).	— 14th (driving)
Thursday, 15 ,,	Barraba	10 a.m. ...	— 14th (driving)	3 p.m., 15th.
Friday, 16 September..	Manilla	10 a.m. ...	5·10 p.m., 15th	5·50 p.m., 16th.
South Coast, No. 1—				
Tuesday, 13 September	Nowra	2 30 p.m .	12·47 p.m., 13th	— 14th (driving)
Thursday, 15 Sept. .	Milton	10 a.m. .	— 14th (driving)	— 16th (driving)
Monaro, No. 1—				
Wednesday, 14 Sept....	Adaminaby ...	10 a.m. ..	— 13th (driving)	11 a.m., 15th (driving).
Friday, 16 September..	Cooma	10 a.m. .	— 15th (driving)	6·5 p.m., 16th.
Saturday, 17 Sept. ...	Queanbeyan ...	10 a.m. ...	9·29 p m., 16th	9·50 p.m., 17th.
	Week ending 24 September.			
Northern, No. 10—				
Thursday, 22 Sept. ...	Tamworth ...	10 a.m. ...	5·40 p.m., 23rd	5·50 a.m., 23rd.
Friday, 23 September	Walcha..	11 a.m. ...	10 a.m., 23rd ...	5 p.m., 23rd.
Saturday, 24 Sept. ...	Armidale	10 a.m. ...	8·50 a.m., 24th	9·10 a m., 26th.
South Coast, No. 2—				
Monday, 19 September	Moruya	10 a.m. ...	— 17th (driving)	— 20th (driving)
Wednesday, 21 Sept.	Cobargo	10 a.m. ...	— 20th (driving)	— 22nd (driving)
Friday, 23 September	Bega	10 a.m. ...	— 22nd (driving)	— 24th (driving)
Southern, No. 12—				
Monday, 19 September	Braidwood ...	10 a.m. ...	8·10 a.m., 19th (driving).	6·10 p.m., 19th. (driving).
Tuesday, 20 ,,	Picton	10 a.m. ...	3·45 a.m., 20th	4·34 p.m., 20th.
Wednesday, 21 Sept...	Camden	10 a.m. ...	6·47 p.m , 20th	3·15 p.m., 21st.
	Week ending 1 October.			
Northern, No. 11—				
Monday, 26 September	Guyra	11 a.m. ..	10·14 a.m., 26th	10·14 a.m., 27th.
Tuesday, 27 September	Glen Innes ...	2 p.m. ..	11·25 a.m., 27th	8·30 a.m., 28th.
Wednesday, 28 Sept.	Deepwater ...	10 a.m. ..	9·14 a m., 28th	9·14 a.m., 29th.
Thursday, 29 Sept. ..	Tenterfield ...	11 a.m. ..	10·36 a.m., 29th	6·38 p.m., 29th.
Monaro, No. 2—				
Monday, 26 September	Bombala	10 a m. ...	— 24th (driving)	7·20 a m., 27th.
Central, No. 2—				
Wednesday, 28 Sept...	Liverpool... ..	11 a.m. ...	10·30 a.m., 28th	4·30 p.m., 28th.
Thursday, 29 Sept. ...	Gosford	11 a m. ...	10·50 a m., 29th	4·50 p.m., 29th.
Friday, 30 September	Wyong	11 a.m. ..	10·50 a.m., 30th	4·42 p.m., 30th.

Bitter Pit.

It has been decided that a scientific inquiry shall be made throughout the Australian States into the causes of the serious disease "Bitter Pit," which affects certain apples, and which has been so prejudicial to our export trade. The Department will be glad if every apple-grower in the State will assist by giving specific information on the following points, in order that, the causes being known, remedies may be found:—

1. What varieties of apples do you grow, and which are most affected by Bitter Pit?
2. At what age of the trees have you found the fruit most seriously affected?
3. What class of soil and subsoil have you on your orchard? Have you noticed any differences in the prevalence of Bitter Pit on different qualities of soil?
4. Has pruning, whether severe or light, any influence on the disease?
5. Is it affected by the variety of stock used? Is it conveyed by scions?
6. Has manure, whether natural or artificial, affected it in any way?
7. Have you tried liming? If so, with what results to the affected trees?
8. Has sub-drainage any effect, beneficial or otherwise, on the disease? Is it affected by stagnant surface water?
9. Have you noticed any difference caused by the position or aspect of trees? Have sea breezes or any other prevailing winds any effect?
10. Mention any remedies you may have tried, and any circumstances you may have noticed which affect the prevalence of the disease.

Kindly address replies to the Under Secretary, Department of Agriculture, Sydney.

Notes on some Plant Diseases.

T. HARVEY JOHNSTON, M.A., B.Sc., Bureau of Microbiology, Sydney.

A.—Irish Blight in Tomatoes.

THE fungus *Phytophthora infestans,* which produces the condition known as Irish blight, and which is now so well known in our potato-fields along the tablelands and coastal districts, has during the past few months attacked the tomato crop.

The main characters of the fungus and of the disease produced by it in potatoes have already appeared in the *Gazette.** Its appearance and effects on the tomato plant are very similar. The fungus occurs on the leaves and stems as a delicate whitish mildew, which, on examination under the microscope, is seen to consist of abundance of threads *(conidiophores).* These conidiophores arise from that part of the fungus which lives within the plant tissues, and reach the exterior through the "breathing-pores" or stomata in the case of the leaf, or through the epidermal cells in the case of other parts. They may be simple, but are usually branched, and at the end of each branch there is produced a small, somewhat lemon-shaped conidium or spore. These conidia are very easily detached from their conidiophores by mechanical means such as wind, rain, or contact of any description, and are capable of producing fresh infection. Infection from these spores may be brought about in different ways. In one case the spore breaks up into a number of tiny motile bodies called zoospores, which are capable of swimming in water (*e.g.*, dew, rain) for a little time, and may thus, perhaps, reach another host or another part of the same host. The zoospore comes to rest, and, on germination, gives rise to a mycelium capable of penetrating the living plant tissues or of gaining access by the stomata in the case of a leaf. In the other case the spore may not break up into zoospores, but may give rise to a germ tube. This may develop into a mycelium, or it may produce a body like itself, termed a secondary conidium. By this second means the spore is capable of extending the period of its existence, and also increases its chances of meeting with a suitable host. It is thus seen that the spores may become widely scattered, and infect large areas. Consequently it is of the utmost importance to carefully remove and burn the diseased tomato plants.

It need hardly be mentioned that anything which tends to destroy the leaves of a plant must injure the plant itself, and must have its influence on the developing fruit. Unfortunately this is not the only effect that *Phytophthora* has on the fruit. The spores are able to infect it just in the same

* See *Agric. Gazette, N. S. Wales*, November, 1909, p. 1004, and "Farmers Bulletin, No. 31, p. 11.

way that they do the potato tuber, and when once infected the mycelium which develops from the spores is able to make its way very readily through the soft tissue just under the skin of the fruit. As it grows at the expense of this tissue, the latter soon dies at the point of attack, and becomes brown. Thus mottled-brown discolorations are seen showing through the clear skin, and if the fruit be cut across the discoloration is seen to extend more or less deeply into the pulp.

The accompanying photograph of specimens collected in North Sydney district by Mr. Inspector Hunter gives a very fair idea of the appearance of infected fruits. The large figure shows the brownish depressions which are characteristic. Other specimens depict various stages in the development of the condition, whilst the dense white growth of the fungus, induced by keeping the tomato under favourable conditions of temperature and moisture, is seen in the bottom figure.

It cannot be too strongly impressed upon growers that this disease is infectious. The spores from the leaf, stem, or fruit of the tomato readily infect any part of the potato plant, and *vice versa*. Again, the packing of one tomato infected with *Phytophthora* may be the means of spoiling the remainder of the case, as warm, moist conditions favour the development of the fungus. Great numbers of spores are produced on the conidiophores after the latter have been pushed out through the skin of the fruit, and these spores are able to infect the surrounding tomatoes.

Decay generally follows very soon in the wake of *Phytophthora*, since various fungi and putrefactive bacteria attack the dead and dying tissues.

Relation of Phytophthora to Potato and Tomato Crops.

Another very important point to remember is that along our coast districts it is quite common for the grower to plant tomatoes while the potatoes are growing, and as a result the tomato crop is harvested partly at about the same time as the earlier and later potato crops, and partly after these crops have been dug. Thus the infection may pass from the potato to the tomato, and be carried on for six or seven months of the year at least, merely by means of spores. For example, it is not difficult to find tomatoes suffering from blight just now (June). It will thus be seen that for the greater part of the year *Phytophthora* may have a suitable host and more or less suitable conditions for its growth. However, we have noticed that the hot summer weather has a decided tendency to hold the disease in check.

The remedies—or to be more correct, the preventives—have already been discussed in connection with the disease in potatoes. Some authorities recommend that the spraying should be commenced when the plants are about 6 inches high, but there have recently been submitted to this Bureau samples of potato plants, only 3 inches in height, which showed the presence of the disease. This leads one to the conclusion that thorough spraying with Bordeaux mixture should be commenced very early, and should be continued just as often as is necessary to maintain a coating of this fungicide on the stems and the upper and lower surfaces of the leaves.

Tomatoes affected with Irish Blight.

The efficacy of Bordeaux mixture as a fungicide in the case of blight in potatoes has been tested recently by Mr. W. J. Allen, Government Fruit Expert, the result being highly satisfactory.*

B.—Potato Diseases.

During the past few months some rather interesting complications in regard to diseases of local potatoes have been noticed at the Bureau. Both leaf spot *(Alternaria solani)* and *Phytophthora* are fairly commonly met with on the same leaf, especially in specimens from our northern rivers. Other less common occurrences coming under notice were blight, bacteriosis, and gallworm in the same tuber; blight, wireworms (larvæ of click-beetles), and potato-moth larvæ *(Lita solanella = Gelechia operculella)* in the same tuber; bacteriosis, gallworms, and *Rhizoctonia*; white ants *(Termitidae)* and *Phytophthora*.

Another very interesting series forwarded to this Bureau for examination and report showed the presence of cord-like strands of the honey fungus *(Armillaria mellea)* on the outside of and permeating the whole tuber. This mushroom also attacks and destroys the roots of various orchard trees (orange, lemon, apple, &c.) in this State.

C.—A Scab on Apples.

The commonest scab occurring on local apples is the so-called "apple-scab," or "black spot," produced by a very dense, flat-growing fungus known as *Fusicladium dendriticum (Venturia dendritica)*. A very closely-allied, if not identical, fungus *(F. pyrinum)* is the cause of a similar disfigurement of the fruit of the pear. Both of these fungi also attack the leaves. They may be kept in check by a few thorough applications of Bordeaux mixture.

Another scab occurs on our apples. Specimens submitted recently by a grower in the New England district showed the presence of another scab-producing fungus, *Coniothecium chromatosporum*. The effects resulting from its attacks are well shown in the accompanying plate. A roughening of the skin is produced, generally forming a scar-like band, which commonly encircles the fruit in a manner shown in the upper and lower figures in the plate. In these it will be noticed that the end (or ends) of the fruit remain normal, while the middle part of the exterior shows a distinct difference in colour and texture, being greenish or brownish, rough and somewhat scaly. These scales are represented in the two middle figures, in one of which it will be seen that the whole of the surface of the fruit has been attacked. The scales are rather small, flaky, and readily detachable. On the darkened surface of each there will be found, if examined microscopically, myriads of spores of different kinds, most of them being of the type which occurs in the genus *Coniothecium*, arising from a mycelium of fairly thick-walled fungus-threads, or hyphæ. The condition reminds one of that called "grey scab," found on the orange, lemon, and mandarin in Sydney district, the flakes in this case containing hyphæ and

* See Mr. Allen's article, page 571 of this issue.

spores somewhat similar to those mentioned above, but belonging to an allied fungus, *Sporodesmium griseum.*

The *Coniothecium* may sometimes be the cause of considerable cracking of the fruit, just as may occur from the attacks of *Fusicladium* in the case of the apple and pear, and from the presence of *Rhizoctonia* on the potato tuber.

In regard to treatment, the grower stated that he had been able to control the "black spot" by using Bordeaux mixture, but that this condition had resisted its action. Probably further applications would have the desired effect. The removal and destruction (by burning) of diseased fruit is advisable.

Dairying on the Comboyne.

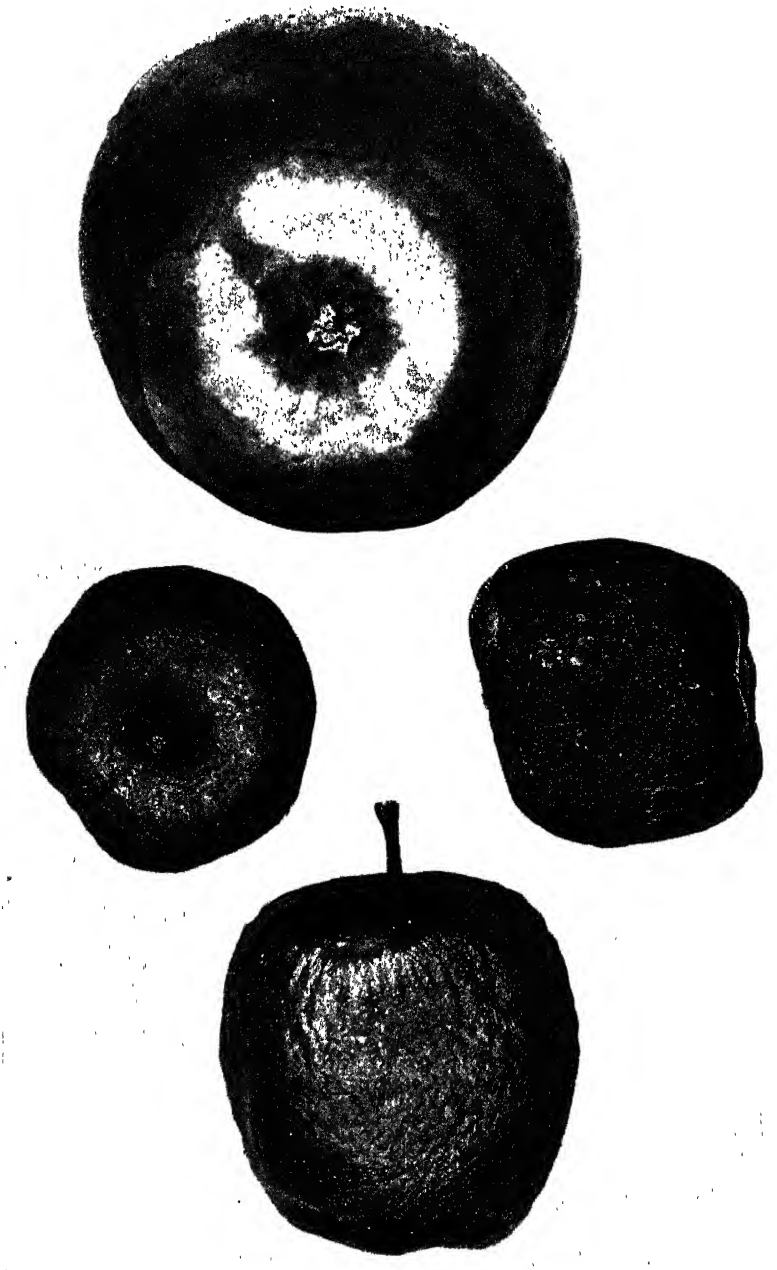
In April last, at the request of Mr. R. Baldwin Jenner, Hon. Secretary, Board of Provisional Directors, Comboyne Co-operative Dairy and Produce Company, Mr. C. Pedersen, Dairy Instructor of the Department, was sent to the Comboyne to advise as to the practicability of erecting a butter factory to be driven by water power. Mr. Pedersen's report contains some interesting particulars relative to this little dairying centre.

The district bears a great resemblance to the big scrub on the Richmond River, but there is not so much good timber; in fact, there is very little hardwood at the top of the Comboyne proper, and fencing materials have already become a little scarce.

The soil is very similar to that of the Richmond, but the country is much more undulating; so much so that in Mr. Pedersen's opinion large herds cannot profitably be run on account of difficulty of travelling to milking yards and water.

The country is still in a very rough state, the amount of clearing done and grasses sown being small. Paspalum, rye, prairie, and cocksfoot grasses and clover have been sown and are all doing well. There are about eighty settlers on the Comboyne proper, and quite a number on the mountain sides. About two dozen are doing a little dairying, the east end settlers sending their cream to the Lower Manning and the west end settlers to Wingham. None of the roads are yet metalled, and some not formed.

Mr. Pedersen recommended a site for the proposed factory on a recreation reserve near the Government village of Comboyne, where no settlement has taken place, the position not being deemed sufficiently central yet for a village, being about a mile off the main road. Water power to the extent of at least 100 h.p. can easily be obtained in this locality, as there is a large waterfall in a suitable position.



Apples showing the presence of "Scab" due to the Fungus *Coniothecium*.

Apples for Cold Storage.

W. H. GRANT, Orchardist, Bathurst Experiment Farm.

Now that the apple industry in this State is assuming fair proportions, with a promise of a large increase in the near future, attention must be given to the most profitable method or methods of disposing of our surplus fruit. The advisability of exporting portion of our output is already being tested, but the question as to whether it is profitable to place portion in cold storage, and hold until there is a scarcity of fruit on the market, is one that must receive serious consideration on the part of orchardists in this State before very long.

With a view of bringing this matter prominently before growers, I propose to give a few of the most salient features that have come under my notice whilst engaged in this industry in Victoria. That the cold storage of fruit

Packing Shed, Bathurst Experiment Farm Orchard.

is highly profitable cannot be doubted when consideration is given to the effect it has had on the industry both in the United States and also in Victoria; and the possibility of being able to supply our markets in the off season instead of importing from America is a matter that must appeal to all concerned.

When fruit is marketed immediately it is ready, the effect in a good season is to produce a glut, which results in ruinously low prices, allowing of practically no profit to the grower after deducting the cost of labour, cases, and freight. These gluts are caused not by over-production, but by faulty distribution, and the only remedy lies in cold storage; for by this means the fruit can be supplied to consumers in a sound and wholesome condition during the greater part of the year.

The apple (which I propose dealing with chiefly) ripens rapidly and then degenerates, in high temperatures; but in cold temperatures the process of ripening is retarded, and its life is consequently lengthened considerably.

The keeping qualities of the apple in cold storage depend on the variety stored, and in a large measure on the condition of the apple when it leaves the orchard.

It has been found that the apples most adapted for storing are the later varieties, such as Stone Pippin, Rome Beauty, Rokewood, Yates, Statesman, Dougherty, and Granny Smith.

Those varieties which mature more quickly than others deteriorate more quickly in cold storage; hence it would be unwise to store the earlier varieties for any prolonged period.

Some growers imagine that apples picked on the green side, in a partly-coloured state, have better keeping qualities than those that have been allowed to mature. Experience, however, has taught that the fruit should be allowed to come to maturity on the tree, and should be picked when fully developed (without being overgrown), highly coloured, but still hard and firm. This fruit is superior in flavour and texture, more attractive to the purchaser, and of greater commercial value. The mistake, however, must not be made of allowing the fruit to become overripe, for as it is then near the end of its life it will go off quickly.

Three methods are used for cold storage:—

(1) Direct expansion;
(2) Brine circulation;
(3) Dry air circulation.

The lastnamed is generally admitted as being the most satisfactory.

It has been found by experiment that the temperature in the cool chamber should be kept from 31 to 32 degrees Fahrenheit, and fruit will remain in much better condition after being taken from this temperature than after being taken from a temperature of, say, from 35 to 36 degrees Fahrenheit. It may prove satisfactory to store fruit in a temperature of 35 degrees Fahrenheit in a cool chamber erected near the orchard, in which it may be placed immediately after picking; but for general commercial purposes a temperature of 32 degrees Fahrenheit is necessary in order to prevent any ill effects from the handling of the fruit, which results in a certain amount of bruising. As fruit matures more quickly after picking than whilst on the tree, it should be placed in cold storage with as little delay as possible. For the same reason apples should not be packed whilst hot, or be exposed to the sun or kept in close buildings after picking, but should be kept in a well-ventilated or open shed.

The greatest care should be taken in packing fruit for storage. The cases should be well lined with lining paper; the apples should be wrapped individually in wrapping tissue-paper, preferably waxed tissue-paper, and the lids should be secured. If ordinary wrapping-paper is used, a double wrapper is found more effective, but should wax paper be used only one wrapper is required.

The careful wrapping and packing of the fruit in this way prolongs its life, and more than compensates for the additional cost. Apples that are packed loosely in a case to which the air has access are apt to wilt if the humidity of the air be allowed to fall below 75 per cent. The wrapping of each apple prevents the transfer of rot from one apple to another, and reduces to a minimum the danger of bruising in handling.

The extra cost of storage is practically small compared with the increased returns that are realised. At present the cost for a period of six months should not exceed 1s. 9d. per case, and it is highly probable that this amount will be reduced considerably when more provision is made and when cold storage becomes more general. The cost in a privately-owned cool chamber with a capacity of 10,000 cases should not be more than 1s. per case for the same period, after allowing 5 per cent. interest on capital invested and 10 per cent. for depreciation of plant.

In erecting a plant to hold, say, 5,000 cases, it would be advisable to put in machinery capable of dealing with 10,000 cases, as the work would be done better and the capacity could be increased at any time if desired by the erection of an additional chamber.

I would recommend the installation of an 8-ton Linde compressor and a 24 horse-power suction gas engine. The cost of these, with the necessary appliances, pulleys, belts, &c., would be about £1,200.

Three chambers, each 40 feet x 24 feet x 8 feet, would cost about £1,500, including engine-room, sheds, &c., so that the total cost would be about £2,700. The cost of a plant for 5,000 cases would be approximately from £1,800 to £2,000.

The percentage of loss of fruit depends on the variety stored, but should not be more than 5 to 7 per cent., and might even be as low as 1 per cent.

As against this increased cost and loss in storing may be placed the much higher values that will be realised when the fruit is disposed of. As high as 20s. per case has been realised in this State, and also in Victoria, for fruit after being in cold storage for six months. It is only reasonable to expect that the return should not be less than from 12s. to 16s. per case for good fruit.

One example may be quoted of an orchard in Victoria of 134 trees, which, during a period of three years in succession, averaged eight cases per tree, or 1,072 cases, during each year. The price realised, after storing for six months, was £536 per annum, or a total of £1,606 for the three years. The variety grown in this instance was Yates.

The price asked for and received for the American shipment last year was about 20s. per case.

Dry Farming Conference.

THE attention of farmers interested in "Dry Farming" is drawn to the fact that the Department of Agriculture is arranging a Conference on that subject, with special reference to wheat-growing under dry conditions. Proceedings will commence on Tuesday, 19th July, in the Exchange Buildings, Bridge-street, Sydney, this date being fixed for the convenience of members of the Farmers and Settlers' Association, numbers of whom will be delegates at the Conference, and whose annual meeting is being held about that time.

The Conference will be open to any farmers who may wish to attend, and any of them who have given their special attention to this subject should communicate with the Department of Agriculture as soon as possible, so that provision may be made for their taking part in the discussions and reading a paper if so desired.

It will also be interesting to note that in conjunction with the Conference, Professor Watt, recently appointed to the Chair of Agriculture at the Sydney University, will deliver a lecture on "The Conservation of Soil Moisture"; and it is also proposed that Senator McColl should give an address relating to his experiences at the last Congress on Dry Farming in America.

These addresses, which will be given on Tuesday and Wednesday evenings, the 19th and 20th July respectively, should prove especially interesting to all concerned in this question, which bears upon the profitable utilisation of so much of our farming lands.

Spraying Experiments at West Maitland for the Prevention of Potato Blight.

W. J. ALLEN

On Wednesday, the 25th May, I visited West Maitland for the purpose of inspecting the potatoes which were sprayed on the 2nd, 3rd, and 5th idem, for the prevention of Irish blight.

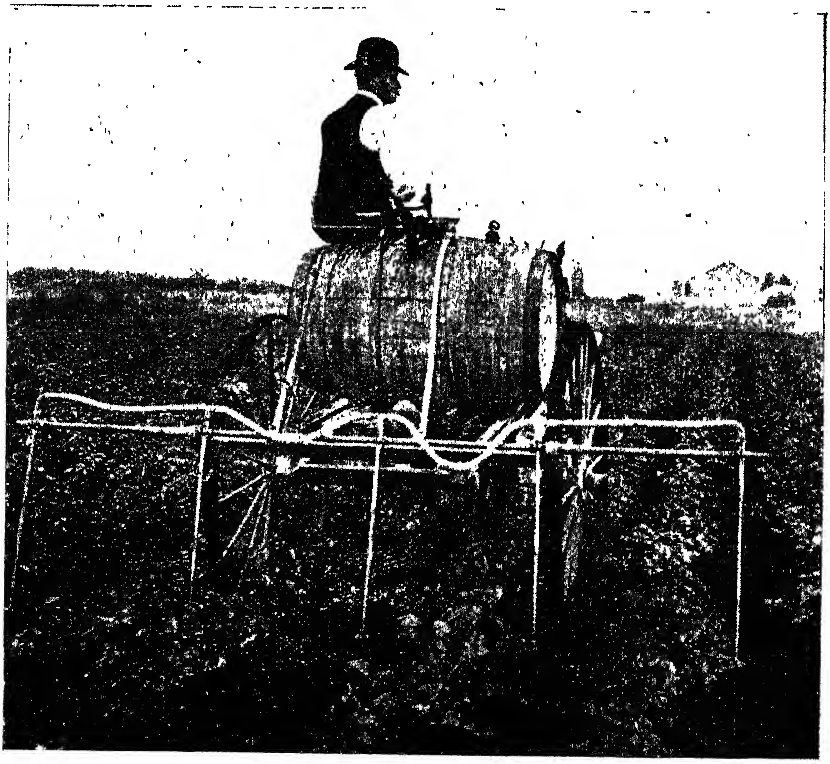


Fig. 1.—Imported Spraying Machine, 5 rows.

The experiments were carried out on Messrs. W. Tiedman and G. Mudd's properties, in addition to the Government Experiment Plots, all of which are quite close to Maitland. Mr. Tiedman's potatoes were young, and at the time of spraying only a little blight was showing. Mr. Mudd's were older,

Fig. 2.—Imported Potato Sprayer at Work.

Fig. 3.—Portion of Government Plot, West Maitland, Sprayed.

with considerable blight showing; while on the Government Experiment plots the blight was showing badly.

Mr. Tiedman's plot was sprayed twice, on the 2nd and 4th instant. A few rows on the Government Experiment plots had two applications, while a portion was left unsprayed. One quarter acre of Mr. Mudd's potatoes were sprayed twice.

The only beds of potatoes in the Maitland district with green tops are those which were sprayed, the spraying having the effect of checking the spread of the disease on potatoes with haulms badly infected, and many of them have since put on fresh growth.

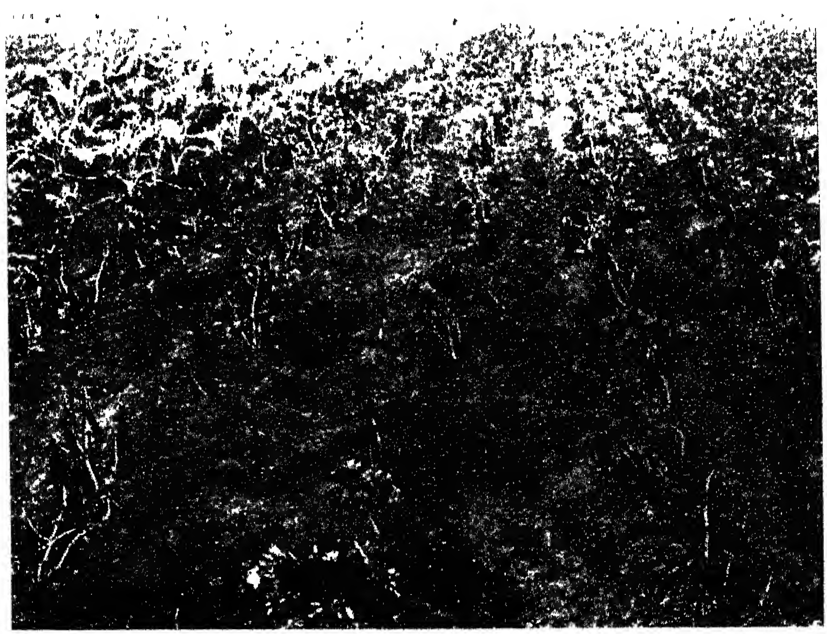


Fig. 4.—Portion of Government Plot, West Maitland, not Sprayed, showing Dead Haulms.

Potatoes unsprayed in the near vicinity, which were in apparently healthy condition at that time, have since succumbed to the disease, while the majority of those sprayed have continued to grow.

Although this experiment was started rather late in the season, it has served to demonstrate that spraying, when properly carried out, has the effect of preventing the spread of blight. This in itself is nothing new, as it has been proved in other countries, wherever the disease has made its appearance, that potatoes which were systematically sprayed cropped heavily and were not affected to any appreciable extent by this disease, while those

which were not so treated succumbed. The experiment therefore is only another testimony to the efficacy of using preventive measures.

I am sorry to say that the potato-growers of the Maitland district have not taken the interest in this experiment which might have been expected of them. Many of those living within a few miles have not even inspected the plots either at time of spraying or since. Those, however, who have visited the plots are, I feel sure, convinced that spraying will have to be carried out in some systematic way if potato-growing is to be again made possible or profitable throughout this Valley of the Australian Nile (Hunter River). It is a question whether or not spraying should not be made compulsory in districts where blight has made its appearance.

Fig. 5.—Mr. W. Tiedman's Potato Plot, West Maitland, Sprayed Twice.

The machine which we used sprayed five rows at a time, and 100 gallons of the solution was sufficient to cover about 1¼ acres.

The Bordeaux mixture and copper soda sprays were used, but no difference could be observed in the results obtained from either. If copper soda spray were to be used, 14 lb. of washing soda would take the place of 8 lb. of lime. By using this latter mixture the cost of ingredients would be about 1s. per 100 gallons higher than where the Bordeaux Mixture was used.

Cost of Ingredients for 100 gallons.

	s.	d.	
14 lb. washing-soda @ 1d. per lb. ...	1	2	Burgundy or copper soda mixture.
12 lb. bluestone @ 3d. per lb. ...	3	0	
	4	2	
12 lb. bluestone @ 3d. per lb. ...	3	0	Bordeaux mixture.
8 lb. lime @ £2 per ton, say ...	0	2	
	3	2	

Although the above is the strength usually recommended, I am of opinion that an additional 3 lb. of bluestone and a corresponding proportion of lime would be more effective.

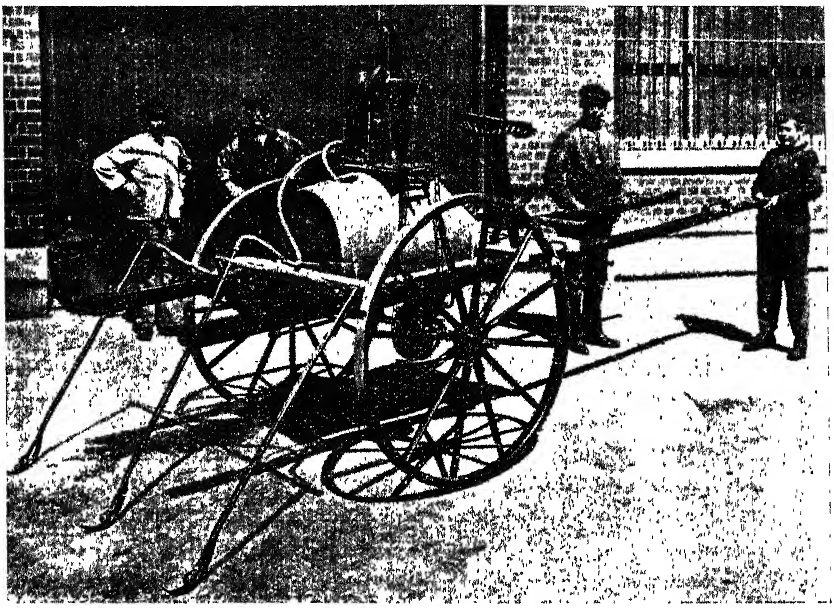


Fig. 6.—Tasmanian-made Potato Sprayer, 8 rows.

Two men, with a good horse, could easily treat from 12 to 15 acres in ten hours.

Mr. Elias Bowden, a prominent grower in the Maitland district, who assisted the Department in connection with the Government Experiment Plots, has supplied the following remarks, which speak for themselves:—

Having had an opportunity of working the machine for spraying potatoes on the Agriculture Plot, West Maitland, which were affected with Irish Blight, I was well pleased with the way it did its work; also with the rapidity with which a few acres can be treated. I am also satisfied that spraying had a beneficial effect upon the potatoes affected with blight. To give the spraying a fair trial, some were not sprayed, and in the course of ten or twelve days you could see a marked difference between those sprayed and those not sprayed. The unsprayed potatoes had gone black, and dried

up; but those sprayed remained green, and stalks that had been affected regained their vigour. New growth had taken place, and they were quite fresh again. I also found when harvesting the potatoes that the tubers of the unsprayed potatoes were more affected than those of the sprayed ones. I am satisfied that the spraying has done good, and checked the disease. The potatoes were well matured, and the blight had a good hold before the spraying was done. Therefore, I am satisfied that if the spraying were done as soon as the potatoes were high enough to spray, and repeated several times whilst the potatoes were growing, it would have a beneficial result upon the crop.

Soy Beans.

"On paper" there is no question about the value of soy beans as a farmer's crop. American experience is that compared with cowpeas they are more valuable as a grain producer, whether to be pastured or threshed. They are hardier and more drought resistant; they can be grown earlier and later in the season, thus ensuring a longer succession of feed; and they produce a grain much richer in protein, or muscle-producing constituents, being the richest of all natural vegetable foods. In Henry's "Feeds and Feeding," the protein contents of soy bean and cowpea seed are given as 34·0 and 20·8 per cent. respectively.

Whilst cowpeas are extensively grown in New South Wales as a soiling or grazing crop and soil renovator, soy beans have not taken the place in cultivation which their value would seem to warrant. For some unexplained reason the legume has not shown that it will thrive over such an extent of the State as cowpeas, though experiments conducted by the Department on a large scale have shown that it will prove a good crop for farmers in suitable districts to grow for their own use. As far back as 1893 Mr. G. Valder found that a variety known as "Improved White," imported from the United States, yielded at the rate of 47 bushels of dry pulse per acre (see *Agricultural Gazette*, Vol. IV, 1893, page 915).

At the Hawkesbury Agricultural College the plants and beans have been found of great value as fodder for cattle and pigs, though, of course, owing to the high protein content, soy beans must be mixed with other fodders such as maize, barley, rye, or potatoes, to balance the ration.

Soy beans are also a delicious table vegetable, if shelled whilst quite green, and the plants, after the pods are taken off, make very good feed for cattle.

As we are still importers of pulses, soy beans seem to be worth further trial, and farmers are advised to test them in a small way to see if the district suits them.

Production and Consumption of Potatoes in New South Wales.

GEO. HAINSWORTH, Export Branch.

For the five years 1904-8 (1909 figures are not yet available) the New South Wales potato bill amounted to £2,457,450, out of which our farmers took £1,381,108, the balance of £1,076,342 being paid to others outside the State. Or, to put it in another way, our yearly average consumption was valued at £491,490, from which we paid to New South Wales growers £276,222, and to producers outside the State £215,268; the quantity produced being little more than one-half of the State's requirements.

The quantity exported is practically inter-State transfers—that is to say, potatoes which are landed at Sydney and transferred to other boats for ports outside the State. But as these transhipments are included under the head of imports they have to be taken into account, and are classed as exports on leaving the State; and the difference between the total imports and these transhipments is the quantity kept in the State for consumption.

There was a gradual increase in the area under crop from the year 1904 to 1907, in which latter year 36,815 acres were cultivated, being an increase of 15,964 acres over the year 1904. In 1908 there was a decrease, as compared with 1907, of 4,898 acres, but an increase of 11,066 acres as compared with 1904.

From the following figures it would appear that the cultivation of potatoes is deserving of more attention at the hands of our producers than it has hitherto received, as, apart from any direct export trade which might be done, there is room for greater development to supply the State's requirements.

Year.	Area under Crop.	Production.		Imported.		Exported.		Net Imports.		Actual Consumption.	
		Quantity.	Value	Quantity	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	acres.	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£
1904	20,851	1,134,860	106,393	1,593,244	140,385	132,356	16,622	1,460,888	123,763	2,595,748	230,156
1905	23,855	975,080	251,940	1,000,339	333,976	157,978	52,705	842,361	281,271	1,817,441	533,211
1906	26,374	1,007,720	266,615	895,041	299,456	242,666	84,124	652,375	215,332	1,660,095	481,947
1907	36,815	2,297,120	548,470	1,351,300	197,007	452,734	75,041	898,566	121,966	3,195,686	670,536
1908	31,917	1,117,640	207,590	1,635,134	390,697	206,391	56,687	1,428,743	334,010	2,546,383	541,600
Total	139,812	6,532,420	1 381,108	6,475,058	1,361,521	1 192 125	285 179	5,282,933	1,076,342	11,815,353	2,457,450
Mean Annual Average	27,962	1,306,484	276,221	1,295,011	272,304	238,425	57,036	1,056,586	215,268	2,363,070	491,490

Average yield per acre, 2 tons 6 cwt. 2 qrs 25 lb., valued at £9 17s. 6d.; equal to £4 4s. 6d. per ton.

As will be seen, the above figures are for the whole of the State, and the average yield per acre would not appear to be very encouraging to anyone

contemplating the cultivation of potatoes. It is not contended that potatoes can be grown to profit in all parts of the State; but there are districts which, under anything like favourable conditions, can produce all the potatoes required by the State, especially if due regard is given to rotation of crops, clean cultivation, suitable manuring, and up-to-date methods generally.

For instance, it is reported that heavy yields are general throughout the Blayney district, and that one grower near the town dug 10 tons per acre from about 8 acres, receiving an average of 75s. per ton for the whole crop, or a total return from the 8 acres of approximately £300.

Another report shows that in the Crookwell district a large area of ground has been put under potatoes, in a number of instances virgin soil having been ploughed up, and that as much as £100 per acre was made last year, the crops yielding 10 tons to the acre.

There are numbers of other districts which are just as suitable for this industry as the two above quoted, and without doubt potato-growing is deserving of more attention at the hands of those farmers who are living in localities which are eminently situated for the growing of this article of daily consumption.

Importation of Wool and Woollen Goods by Japan.

A recent report from Mr. J. B. Suttor, Commissioner for New South Wales in the East, shows that during 1909 the total importations of wool and woollen goods by Japan equalled £1,694,651 8s., an increase of £351,120 16s. compared with the previous year. In wool and wool tops, the total importations for 1909 equalled £909,200 16s., an increase of £224,183 2s. over the figures for 1908.

Of the 1909 importations, £604,468 6s. was for tops, the same as now being made in Sydney, and £304,732 16s. for raw wool. The previous year's figures were £434,646 4s. for tops, and £250,371 10s. for raw material.

The imports of tops and wool from Australia for 1909 were £199,648 16s., as against £96,966 10s. for 1908—an increase of £102,682 6s.

Mr. Suttor adds that demands for spring goods (cloth, tweeds, &c.) are active, and that his office is keeping the excellent quality of New South Wales wool before the mills of Japan.

Erratum.

On pages 534 and 535 of our June issue, illustrations are given of varieties of Kale grown at Bathurst Experiment Farm. The names of these two varieties should be transposed. The figure on page 534 is Thousand-headed Kale, and that on page 535 is Marrow Kale.

Notes on the Irish or Late Blight of the Potato.

A. T. HUNTER, Inspector under Fruit Pests Act.

HAVING kept in close touch with Mr. T. Harvey Johnston, Assistant Microbiologist, Bureau of Microbiology, I have had the opportunity to study the parasitic fungus, *Phytophthora infestans,* which causes the disease known as Irish or Late Blight of the potato. Mr. Johnston has also kindly explained the characters of the fungus in all its stages. Coupling the knowledge thus gained with practical field observations, I will endeavour to convey, in a simple manner, some information on the nature and habits of the disease.

The disease is caused by a parasitic fungus, for whose exact identification a microscope is necessary. The name of the fungus, *Phytophthora,* means a destroyer of plants. It is really a plant parasite, for it thrives upon and destroys the living tissue of its host.

Before going into any further details as to the fungus, I will quote some remarks by Professor H. Marshall Ward upon some of the functions of the healthy leaf of the potato plant.

> The leaf of the potato-plant consists of enormous numbers of little cells, most of which contain protoplasm, the living substance of the leaf. The protoplasm contains certain green-coloured bodies, the chlorophyll corpuscles, which are so numerous in the myriads of cells that they give the leaf its green appearance. The substance which gives the corpuscles this colour is called chlorophyll, a word meaning leaf-green. This possesses very remarkable and important properties. Whenever the sun shines on one of these green chlorophyll corpuscles, so long as it is alive and healthy and has ordinary air and water in contact with it, this corpuscle has the power of doing a very remarkable thing—it seizes and holds fast the small quantities of carbon-dioxide (carbonic acid gas) which the air contains, and some of the water, and breaks them up and recombines their elements, producing the substance which we know as starch, and setting free certain quantities of oxygen gas.
>
> As fast as starch is made in the green chlorophyll-corpuscles, in every one of the myriads of cells of the leaf, it is handed on in a soluble form, from cell to cell, down the stalks or haulms, to the young tissues which are developing into potato-tubers under the surface of the soil. The formation of the starch in the leaves can only go on during the day, when the sun's rays are shining on the leaves, but this passage onwards of the dissolved substance down the stalks to the tubers goes on actively in the dark as well. Some of the starch in the leaves is used up on the way; it is employed to make new leaves, buds, flowers, &c., or to increase the size of those already formed but not fully developed, and a considerable quantity is consumed on the spot. Nevertheless, at the time when the potato-plant is in full vigour the leaves manufacture far more starch than is required for their present needs; they are storing the surplus in those neat-looking, compact, swollen parts of the underground stem, which we call potato-tubers, where it would normally remain till the following spring or summer, when the sprouting tubers would utilise it to start their new growth, converting it into new cell-walls, shoots, and leaves.

Taking for granted that Professor Ward is correct in the foregoing analysis of the development of the potato-plant, it will be seen that the leaf is a wonderful piece of starch-forming machinery, and its structure is

obviously adapted to its functions. Unfortunately its enemies are numerous and powerful. Its storehouse of starch—the tubers—acquired during its growth, are prized by many animals, man included, and, what is more to our present purpose, by many fungi, and by none more than the fungus *Phytophthora infestans*. Not the least astounding fact about this latter, however, is that its direct point of attack is especially the seat of manufacture of the starch. The fungus first attacks the cells of the leaf, just at the period when it is most busily and usefully employed in forming and passing on the starch.

Herein lies the deadly nature of the pest, that in its epidemic phase it destroys the manufactory, and then follows up its conquest by attacking the stores in the tubers, where it apparently goes to sleep until conditions are favourable for its growth.

It is because the potato tubers contain these dormant hyphæ (or threads of the fungus), that have crept in, that so many of them go bad when stored; and such tubers, if used for seed purposes, are especially apt to reproduce the disease.

I will now relate how the fungus spreads so rapidly from plant to plant during a wet season. Let us take one of the ovoid conidia (meaning an oval-shaped spore, or seed), borne upon the aërial hyphæ or threads of the fungus, which spring out from the disease-spot upon the leaf. If we sow this conidium or spore in water it rapidly undergoes the following changes, if conditions keep favourable:—The narrow free end of the conidium bursts and emits a number of tiny zoospores. Each of these zoospores flits about actively in the water by means of its two cilia, or fine hair-like threads, for about a quarter of an hour or longer, and then settles to rest. It then germinates, putting forth a very delicate hypha, which needs moist conditions for its further development. It cannot withstand drying. If the germination has occurred on the leaf of a potato-plant, in a drop of rain-water or dew, the tiny hypha or thread developed from the zoospore or seed of the fungus dissolves its way through the cell wall into the living substance. It feeds upon this, and then starts a new mycelium (or network of hyphæ or threads), the branches of which spread with enormous rapidity, between the cells of the leaf, and carry on the work of destruction already described. A point of very great importance is that the zoospores can also directly infect the young tubers if they lie on the surface of the soil, or if the conidia are washed down by rain between the particles of soil on to them.

If one reflects that millions of these tiny zoospores may be developed in a few hours, during moist warm weather such as we frequently experience in our coastal districts, the astonishingly rapid spread of the disease is easily accounted for. In an ordinary potato-field the abundant foliage, wet with rain or dew, and full of juices, such as would favour the growth of the mycelium, is swayed by the wind, and leaf flaps upon leaf over the whole area. Thus, quite apart from wind-blown conidia, or spores, the active little zoospores can soon spread from any one centre, and infect new leaves. In a few hours fresh disease spots are developed, each putting forth new crops of conidia, which again germinate and send out zoospores, and so on.

What wonder, then, that the farmer or gardener, having failed to detect the first few diseased plants in his field, awakes some day to the knowledge that many of the plants are infected, perhaps finding two or three days later that every plant in the field is attacked. It appears to be so sudden that he is apt to ascribe the fatal attack to some general influence, and vaguely thinks of frost, hot winds, &c.; but the sudden and widespread outbreak is really due to the simultaneous attacks of myriads of the zoospores, which have been distributed over the field. The obvious connection between the pestilence and the weather is that humidity favours its rapid development, whilst dry hot weather holds it in check.

Passing to the consideration of what means are available to lessen the virulence of this awful pest, it is to be seen that no treatment is likely to succeed which is not based on the scientific knowledge of the habits and structure of the potato, and of the fungus. The case amounts to a rational application of botanical science, and without this agriculturists are likely to go on expending much fruitless time, labour, and money.

It is obviously useless to look for a "cure" for the disease, if by cure is meant some substance which can be applied to a diseased crop, and restore the diseased plants to health. If we take all known facts about the potato blight into consideration, it is clear that our only hope of combating the pest successfully is to take all precautions that tend to prevent the fungus from establishing itself in the potato-fields.

To put the extreme case, it is evident that if we could start with clean soil and plant tubers absolutely free from dormant mycelia, there is no reason to expect the disease, unless spores are carried later into the field.

Now, how are spores carried? They are blown by the wind; they are flapped from leaf to leaf in wet weather; and they may be carried on the clothes of men, the fur of animals, the feathers of birds, or conveyed in bags, and by many other means too numerous to mention. We cannot directly influence all these means of transport, but we can control some of the most dangerous of them. Much may be done by selecting the "seed" potatoes, which should never be saved from plants of a diseased crop. Of course, only a madman would allow the diseased haulms to lie about on the ground, or to be placed on the store-heaps, or in any way to endanger the crops if he understood the foregoing facts; it is because agriculturists do not sufficiently understand the power of this invisible little enemy that so much apparent recklessness is shown in this respect. The haulms should be removed from the ground at once and burnt.

In spite of all precautions, it may happen that a field of fine potatoes begins to show traces of the disease in patches, the fungus having been introduced in a stray tuber, or from a neighbouring garden or field, and that the whole crop is attacked before the presence of the malady is discovered. In such a case every effort is to be made to save the tubers, and one or two statements may be given as to the chief precautions directed to that end. In the first place the young tubers should be covered with several inches of soil if, as often occurs, they are close to the surface, since this decreases the chances of conidia being carried to the tubers by the rain.

The removal (by cutting) of the foliage and stems from the still living plants is sometimes adopted. Much discretion, however, is required to decide when this should be done. In cases where the disease appears in the later stages of the plant's growth it is well to remove and destroy all the foliage and stems, and a fair crop of tubers may still be harvested; but if, on the other hand, the disease has taken a strong hold of the plants when the young tubers are only just forming, the best plan is then to uproot and destroy the plants, for if the foliage and stems were removed from the plant at this stage of growth only a short crop of small worthless tubers would be gathered.

In the foregoing remarks I have endeavoured to impress upon potato-growers the necessity of taking preventive measures, rather than waiting to cure, for should the crop become infected the yield is sure to be considerably reduced, if not entirely ruined.

The following preventives should be adopted as far as practicable:—

1. Only clean seed, obtained from districts where the disease is known not to exist, should be planted, and all seed-tubers should be carried in new bags.

2. Since the seed may appear sound, and yet harbour the spores of the fungus on the exterior surface, it is recommended to soak the tubers (before cutting) in a solution of formalin.

3. Cutting the seed-tubers is recommended, because there is a possibility of detecting the disease. Any tubers not absolutely sound and free from blemish should be rejected and destroyed.

4. Rotation of crops, whereby potatoes, tomatoes, or other solanaceous crops should not follow in the same ground for at least three or four years, will probably cause the fungus to die out of the field for want of its natural host.

5. Spray with the well-known fungicide Bordeaux mixture. The object of spraying is to guard against any possible attack by the spores of the fungus. It is obvious, therefore, that the whole plant should be kept coated with the fungicide. It cannot be stated definitely how often the crop will require to be sprayed. This will depend upon the weather, for it sometimes happens that in a rainy season the fungicide is soon washed off. Generally, however, three or four sprayings, if thoroughly done, should be sufficient. The first application is usually given when the plants are about 6 inches high, and the spraying repeated at intervals of about a fortnight. If the disease is prevalent in the neighbourhood, spraying should commence as soon as the leaves of the plant are formed, for under these conditions the fungus has been found to attack the plants as soon as they have expanded their leaves above the surface of the ground.

As one of the many proofs of the efficacy of judicious spraying, the following is a report which appears in the Year Book of the Department of Agriculture, United States of America, 1901:—

The potato crop was very much reduced in New England, New York, and Pennsylvania by an unusually serious epidemic of late blight. This came late in the season, but the rotting of the tubers following the blight took a large part of the crop in many cases. This disease is almost entirely preventable by spraying, and many thousand acres in potato-growing sections of Maine and other States were successfully protected in this way.

Potato-growing in the Clarence River District.

G. F. KIBBLEWHITE.

In this district a suitable rotation of crops is necessary for retaining fertility in the soil, and farmers are strongly advised to give the matter more attention than it has received in the past. A common practice is to select a low-lying, rich piece of land on account of its high quality, and crop it with potatoes year after year, until it becomes "potato-sick," and has to be abandoned for this crop. Potatoes being preternaturally disposed to disease, especially in such a humid climate as prevails on the Clarence, this practice cannot be condemned too severely. It is simply providing a nursery for disease, and the whole neighbourhood is in danger from its presence. The urgent necessity for the use of fresh ground cannot be too strongly insisted upon.

Soil.

The valley of the Clarence River is mainly a deep, naturally-drained, alluvial sandy loam. Where there is a good supply of organic matter it is very friable and easy to work, and retains the moisture well through the summer months, but in the absence of humus it binds badly after heavy rains. The low-lying lands, which are frequently flooded, still retain a good stock of their original fertility, but signs of exhaustion are frequent on those situated at a higher level, especially in Southgate and around Grafton.

Crops.

The variety of crops is very limited. The lower part of the river produces sugar-cane, but from Lawrence upwards the income of the farmer is drawn from two main sources—the production of milk, which supplies the cream to the butter factories along the river; and the cultivation of maize, for which the Clarence is noted and well suited. Potatoes are grown as a catch-crop, usually preceding a crop of maize. In the winter months the mists from the river are more frequent, and encourage the rapid spread of blight. The foliage of crops is often totally destroyed, and the winter crop is accordingly not much favoured by growers.

Lucerne is commonly grown, but its extension is much to be desired; and cowpeas, pumpkins, melons, tomatoes, and cucumbers are cultivated to a slight extent.

Cultivation for Potatoes.

One of the principal factors in a successful crop is an intelligent cultivation. The chief aim is to obtain a good supply of humus, in order to retain moisture and a thorough free-working texture in the soil, so that it will not bind or run together. Those who have grown potatoes know well that this binding tendency of soils is one of the most common difficulties encountered

in growing potatoes on a soil deficient in humus, and in view of the fact that a great deal of the land which will have to be cropped with potatoes in the future suffers from this defect, this point must be remembered, and some attempt made to remedy it.

A good method to do something along these lines, in the absence of good farmyard manure, is to drill cowpeas between the rows of a summer crop of maize about the middle of October. The corn will be pulled in February, and in dry weather cattle should be turned in on the maize stalks and cowpeas to graze. The cowpeas will be valuable feed for dairy herds at a critical time for grass. The maize stalks will be trampled and broken up, and become thoroughly incorporated with the soil when ploughed deeply in April. This ploughing should be as rough as possible, and preferably by a single-furrow plough. Any frost that occurs will then help to pulverise the soil, which will also store all the rainfall. There will then be an abundant water supply in the soil during the following summer, and a free-working tilth which will not bind under the heaviest rain.

Where it is desirable to break up a paddock or old lucerne patch, the ploughing should also be done at this time, and not left until just before it is required to plant in. This ploughing should also be rough, for the soil is always very dry, particularly after lucerne, and it needs all the winter rains on it before a satisfactory crop can be taken the next summer. Most farmers are quite aware of this fact, but still the practice of waiting until the last possible moment before planting was commonly met on the Clarence—apparently from want of forethought.

Artificial Manures.

The above methods will supply all the nitrogen needed by a potato crop; but phosphates and potash should be supplied as soon as the winter ploughing is completed. Superphosphate and sulphate of potash may be carefully mixed together and sown broadcast. If sown in April or May it will stand a much better chance of becoming well diffused in the soil with the winter rain, and will be directly available for plant-use when required. A good deal of fertilisers sown with the sets at planting time never becomes available for the plant if dry weather sets in, and is often harmful instead of beneficial. Very little will be wasted by broadcasting, providing the rows are not too wide apart, owing to the fact that, given a good tilth, the potato fills the whole of the surface soil with the ramifications of its root fibres.

The application may be made at the rate of—

Superphosphate, 1½ cwt. to the acre
Sulphate of potash, 1 cwt. to the acre.

Planting.

Early planting is recommended in the Clarence district for several reasons, and, if the land is fairly high and not subject to frost, the end of June and beginning of July is advised. Some protection in the form of rough litter would always pay. The whole crop should be in by the middle of July or else left alone.

The potatoes will be ready to dig in October in a well-developed condition, and command high prices. Low-lying land close to the river, which is often bathed in mist and fog, is not the best situation, as there will be danger of trouble from blight and kindred diseases.

Varieties.

Bliss's Triumph.—Both white and pink varieties are excellent early potatoes, producing a fair number of well-shaped tubers. They grow rapidly, and generally speaking the crop is ready for lifting three weeks before any other. The foliage is erect, and this is a useful point, as spraying can be done much more thoroughly than with a spreading haulm.

Centennial.—An excellent pink potato lately introduced on the market. Does well on the Clarence. Deserves more attention.

Manhattan.—Cropped well throughout the Clarence, and gave largest returns. A main crop potato. Foliage strong and erect.

Pink Eye.—Produces a nice sample of potatoes, but haulm spreads badly and straggles on the ground. It would be difficult to spray.

Circular Heads.—Best left alone. It was a conspicuous failure in almost every case.

Infected Seed.

The greatest caution must be exercised in selecting seed. At the present time it is not easy to point definitely to sources where farmers can obtain good clean seed; but this much may be said, bearing in mind what occurred recently: On no account plant with seed grown in the Clarence district. The use of seed infected with blight or other kindred disease is the surest way of infecting the crop grown from it. Anything which appears diseased when the set is cut should be rigidly rejected.

Depth of Planting.

Plant from 4 to 5 inches deep, with 12 inches between the sets and about 27 inches between the rows. Plough in and harrow-cultivate as soon as the haulm is well up, just sufficiently to keep the surface well broken. Hilling is decidedly necessary in the Clarence, where the rains are very heavy when they come, and should be done when the soil is fairly moist, so as not to check the plant.

Harvesting.

Farmers are advised to give more care to the grading of potatoes for market. That "the big sell the small" is only correct when there is a short supply in the market.

There is a practice of covering the mouths of the filled sacks with the stems whilst standing in the field. This should be abandoned, as it involves great risk of introducing potato moth into the tubers.

Australian Dry Farming.

R. W. PEACOCK, Manager, Bathurst Experiment Farm.

ANY system of culture or modification of method which may allow of more certain yields of grain or hay in the semi-arid districts beyond the present wheat belt deserves attention from those who are anxious to push the wheat belt further into the central west, where the soils are admirably adapted for wheat culture, but where the rainfall is meagre and uncertain.

From observation and experiment I am of the opinion that wheat may be grown for grain or for hay under very adverse conditions by the following method. I do not claim that it is applicable or expedient for the present wheat-growing areas, as it has many disadvantages as compared with the more generally accepted methods.

The suggestion is given so that those desirous may give it a trial.

Wheat sown in Alternating Strips with Bare Fallow, Bathurst Experiment Farm.

Choose land for the experiment which has been ploughed about four to five months previous to seed-time, and consequently should have some moisture in reserve. Sow best-graded seed wheat at the rate of 20 lb. per acre upon the area sown, with 8-feet-wide seed-drill, half of which is thrown out of action by closing up half the number of seed vents in the seed-box. The half in the centre of the drill should be closed, the grain being drilled through the holes at either end. This will allow the wheat to be sown in approximately 4-feet strips, leaving alternate strips of 4 feet unsown between the sown strips. Under very dry conditions I would recommend that only 3 feet out of 8 feet be sown, leaving 5-feet wide bare spaces.

In the early spring or end of winter these bare strips should be ploughed 4 inches deep, or cultivated with spring-tooth cultivator to the same depth.

I would recommend the ploughing. Weeds must be kept down on the unsown strips.

The reasons for the suggestion are the following:—

The moisture conserved in the whole of the area would be largely available for the crop growing upon half of it. The rains falling upon the bare strips would benefit the crop growing upon the other half of the paddock. The roots of the wheat would forage in the soil of the unsown strips and tend to keep it from getting out of tilth.

The following year the bare spaces should be sown, leaving the strips which were cropped during the previous year to lie fallow. The roots of wheat which penetrated the bare land the first year would, when upturned, tend to keep the soil in a desirable physical condition for the second crop. The residues of stubble and roots of the first crop would aid in keeping the soil of the bare spaces in a very satisfactory condition throughout the second year. These crop residues would thus do their maximum duty in preventing the soil getting out of condition.

Under the system of bare-fallowing as practised when one crop is grown only once in two years the organic matter (crop residues, &c.) is burnt out, tilth is hard to retain, and the moisture conserved does not do its best on account very often of the unsatisfactory physical condition of the soil.

Against the advantages there are many disadvantages, the principal being the trouble of getting workmen to drill straight, and the inconvenience of ploughing or cultivating between the strips of growing wheat. I am convinced that, under certain conditions, the extra trouble would prevent failure.

The practice at present followed in the drier districts of growing one crop every two years, the land during one year being bare-fallowed, does not tend to long-sustained fertility. This practice may profitably be carried out for a few years after the land is first broken up, but cannot be continued for any length of time without sacrificing that desirable physical condition essential to fertility. The limited rainfalls also do not induce the same satisfactory growth as when the soils were fresher.

It is possible that a greater quantity of wheat could be grown over a series of years from, say, 100 acres, by growing the wheat each year in the same paddock in alternate strips than by growing wheat in one 50 acres and bare-fallowing the remaining 50 acres. If such a method were found practicable after experiment under semi-arid conditions, implements would be devised which would minimise the disadvantages at present existent.

The following are the results from this method at the Bathurst Experiment Farm during 1909:—

Variety, Cleveland; sown, 6th May, 1909.

Sown as in ordinary practice—Estimated yield per acre, 32 bushels 47 lb.
In alternating strips—Estimated yield per acre, 21 bushels 18 lb.

It will be noticed that the yield of the latter, although only half the land was sown, is 4 bushels 55 lb. in excess of half the yield of that sown as in ordinary practice.

Sheep and Wool for the Farmers.

The "Marking" of Lambs.

J. WRENFORD MATHEWS.

The work of lamb-marking embraces ear-marking and tailing, together with the castration of the male lambs. In many districts of this State, especially where the seasons are earlier, lambing may by this time be almost completed, but it is hoped that this article will appear before the "marking" season is finished. Unfortunately "marking" is often followed by considerable mortality. Is this due to wrong methods or negligent use of methods suitable if properly applied? Opinions on this question differ widely, and in the absence of full and reliable data, the Honorable the Minister for Agriculture has directed that, as far as possible, the attention of breeders be invited to this subject, and that a series of experiments be carried out at the various Government Farms, with a view to a definite settlement of this important question.

Generally, all three operations of "marking" are carried out at the same period. At this stage there is considerable diversity of opinion among breeders as to the best age for "marking." Some claim that at about a week or a fortnight there is least risk to the animal and least loss of blood. Two months is quite a common age for treatment, and sometimes the operations are delayed even beyond three months. In cold districts and severe seasons the additional warmth and protection afforded the hind-quarters is a reasonable argument for delay. Taking average conditions as the safest guide, we are inclined to the belief that from three to four weeks is the best age at which lambs should be tailed and castrated. But under almost any circumstances this age must vary. Where the lambing season is unduly protracted there must, at the time the lambs are operated upon, be considerable difference between the ages of the first and last lambs dropped.

Tailing.

The age at which lambs should be tailed is much less in dispute than the method by which the tail should be removed. This is done in one or other of the following ways:—

(1) By cutting the tail off cleanly with a sharp knife.

(2) By burning the tail off with a wedge-shaped iron, heated red-hot.

Formerly the knife was exclusively employed. The method is clean and effective, and, if reasonable precautions are taken, it is safe and reliable. It has stood the test of time, and is still the plan most commonly followed. Hence it does not need extended discussion here.

Where large flocks are concerned the quickness and cheapness of this method serve to keep it in favour. The main point to be observed is that

both the instrument and the wound must be effectively sterilised to prevent infection by micro-organisms.

The knife should be as plain and sharp as possible, since germs may be harboured in joints or corners, and even in cracks in the blade or in the slight irregularities in the cutting-edge. Knives should be sterilised before every operation by immersion in some liquid such as carbolic solution, or in boiling water. If the knife be all in one piece, and the handle continuous with the metal of the blade, so as to permit of the entire instrument being dipped, so much the better.

The point at which the tail should be severed depends somewhat on the sex of the lamb. It will be found best to cut tails of ewe lambs at the second joint from the root, an advantage at both mating and lambing times. In detailing male lambs an extra joint may be left on, as this adds considerably to the appearance of the animal at later stages. If the severed blood-vessels bleed freely, a ligature should be at once tied tightly round the stump. This may be removed as soon as the blood clots and seals the vessels; and in any case the stump should be coated with Stockholm tar.

Latterly the searing-iron has come prominently before the notice of sheep-breeders. The claim that no loss of blood and consequent check to growth followed detailing by this method was sufficient to commend it to favour. It was also thought that the searing would seal the wound, and thus act as a safeguard against tetanus and blood-poisoning in general.

When it was first introduced many advantages were claimed for the searing-iron. Perhaps the matter is still in the experimental stage. Many experienced sheep-breeders believe it to be superior to the knife. But in spite of good results often obtained by its use, we are inclined to think that the searing-iron is not now held in the same opinion as formerly. Complications often follow its use. Frequently the tail swells; still more commonly a nasty sore appears at the end. This may or may not be accompanied by great inflammation, but if it is the animal suffers considerable pain, and rapidly falls off in condition.

In spite of what is claimed for the searing method, cases of tetanus have been traced to its use. We insert a report on two cases from the Experiment Farm at Wagga, which were submitted to the Bureau of Microbiology.

Tetanus.

[From the Annual Report of the Government Bureau of Microbiology, N.S.W.]

About the middle of the year, the Manager of the Wagga Experiment Farm, Mr. McKeown, forwarded for examination the body of a lamb. The accompanying letter stated that one other lamb had died previously, but the *post-mortem* had not afforded any indication of the cause of death. The carcase sent showed only a broken bone near the hip and some effusion of blood, and for the moment it was thought that these lambs might have suffered from inflammation of the end of the bone (epiphysitis) such as sometimes affects young children. In a further communication sent two days afterwards, Mr. McKeown reported that the temperature of the lamb immediately before death was 106·6; its limbs were perfectly rigid, the hoofs being turned backwards from the joint; and the breathing was very laboured. Shortly after death froth appeared at the mouth, but there was no discharge from nostrils or rectum. The dung when last noted appeared normal. This account suggested tetanus, and on further communication and inquiry it was ascertained that the lambs affected had had their tails docked about a month previously. Docking or tailing had been done with a searing-iron followed by application of Stockholm tar and kerosene. Mr. McKeown found other features in

accord with tetanus; the movement of the limbs on occurrence of any noise, &c.; it was noted in the case of one lamb that the limbs were free but the neck was stiff, and the head drawn to one side, a condition very suggestive of tetanus.

The specimens forwarded for examination apart from the first carcase consisted of blood smears, scrotal sac, and tails of three different animals. They did not yield tetanus bacilli to our examination, but the circumstances were not very favourable to its discovery.

The bacillus of tetanus is an anærobe, that is to say, it will not grow in the presence of air. In reporting upon the subject Dr. Cleland remarks: "It seems quite possible that the eschar made by searing by covering over the wound will make perfect the anærobic condition for tetanus and other similiar bacilli to grow in. Infection by such organisms may occur either by the spores being carried into the deeper and unburnt parts of the wound from the wool of the tail during the process of docking, or may occur afterwards by the organisms working through the dead tissues from without. The flush of bleeding after the old method of cutting with a knife may clean out any bacteria which may have already gained entrance." Dr. Cleland calls attention to the mortality from wounds and operations after searing in the old surgical methods, which was remedied by Ambrose Pare's method of ligaturing the vessels without searing. Some of the mortality in question was no doubt due to tetanus.

Another trouble which has been noted after the iron is the swelling of the region along the middle of the back. This is probably due to the iron being insufficiently hot or the tail being severed too close to the root. The tail is a direct continuation of the vertebral column or spine of the body. The vertebral column carries the main nerve axis or spinal cord, and consequently if the tail be cut too short the result is that the animal suffers severely from shock.

The degree of heat at which the iron is applied is of considerable importance. If too hot, the stump is not effectively seared, the blood-vessels gape, and considerable loss of blood results. If, on being taken out of the fire, the iron is found to be white hot it should be allowed to cool to a red heat. It should be allowed to burn gradually through the tail, only light pressure being required. On no account should the tail be pulled towards the iron.

Though the searing-iron method must not be condemned without trial, yet it may in general be asserted that the superiority claimed for the searing-iron method has not been entirely borne out by experience.

The following extract from the *Gazette* of November, 1909, on experiments at Bathurst, and report from the manager of the Experiment Farm at Glen Innes, contain the data now available:—

Removal of Tails Experiment at Bathurst.

During the last few years an impression is abroad that the removal of lambs' tails by searing has advantages over using the knife. Several years ago the two methods were tried at this farm, and no advantage was apparent from searing. A few of the seared lambs swelled rather badly along the spine.

Last year an experiment was carried out, and the effects of the methods gauged from the weights of the lambs at different stages of their development.

The searing-iron was used on twelve lambs, two each of six different crosses, and the knife used upon the same number from the same crosses. All the lambs were male. They were operated on when they were approximately ten days old.

The average weights are as follows:—

	1st Aug., 1908.	1st Sept.	1st Oct.	1st Nov.	1st Dec.
Knifed ...	19⅔ lb.	27⅚ lb.	37¼ lb.	46⅔ lb.	57¾ lb.
Seared ...	19¾ ,,	27¼ ,,	36⅔ ,,	46¾ ,,	57⅙ ,,

The above figures do not show any advantage from searing, though the seared are rather at a disadvantage, but the very slight differences are not sufficient to warrant the assumption that it interfered with their development.

Searing *v.* Cutting off Lambs' Tails with a Knife.

Glen Innes Experiment Farm, 27th November, 1909.

Twelve Southdown × Lincoln-Merino lambs were chosen for an experiment, six had their tails seared off with a hot iron, and the remaining six had their tails cut off with a knife in the ordinary way. The age of the lambs on the date of operations was about 17 days.

They were all weighed just prior to their being operated on, and again about three weeks later, with the following results:—

Method of Tailing.	Average weight on 17th Nov.	Average weight on 9th Dec.	Average gain per lamb.
Cut off with knife ...	22·25	35·41	13·16
Seared off	21·5	33·33	11·83

Total average gain in favour of those whose tails were cut off is 1·33 lb., or about 1⅓ lb. each.

In the absence of fuller information the respective merits of cutting and searing cannot be finally decided. Searing is certainly slower, more troublesome, and of all operations to which sheep are subjected it is the most painful. Some critics describe it as cruel and barbarous. Everyone who has held a lamb while it underwent detailing by this method must have felt the shudder that passes through the whole body of the animal. Unless, then, further experiments show some decided advantage to be obtained by its use, we should revert to the knife.

Whichever method be employed, success depends upon the efficiency and care displayed by those in charge of operations. If lambs are treated in dirty or dusty yards or under damp and cold conditions it is not reasonable to expect the best results. Frequently lambs are tailed and castrated in yards where manure has been accumulating for years. Often dirty knives are used, and sometimes no disinfectant whatever has been employed. Due regard must be paid to all these factors if undue mortality is to be avoided.

Castration.

This operation, although a very simple one, is often accompanied by great loss of life, and every precaution should be taken to guard against this. As in the matter of tailing, so in that of castration experts differ as to which is the best way of opening up the scrotum, and two different methods are followed—

(1) The lower end of the scrotum is cut off.

(2) The scrotum is slit from back to front, and the testicles pressed through.

Most commonly the end of the scrotum or purse is cut right off and the testicles drawn out with the teeth. This should be done promptly and steadily, snatching being carefully avoided. This is the quickest and simplest method of treatment. Many men, however, object to performing the operation in this manner, describing it as a filthy and disgusting practice. Small instruments are now sold for the purpose, and no doubt prove very useful in cases where the operator has not good teeth or objects to employ them in this way.

In both cases the lamb is securely held with its back firmly placed against the body of the holder. In this position it is placed upon a suitable structure, usually the rail of a fence.

In the first case the operator grips the purse and pushes the testicles up towards the belly. He next cuts the end off the purse, but no more than will allow the testicles to escape on being let down again. These are then pushed out and severed from the spermatic cord in the manner already indicated. Sometimes the cord is cauterised, which it is claimed prevents any rush of bleeding. Where the searing-iron is in vogue for removing the tails it may be used to advantage for this purpose.

The other method of performing the operation is to cut the purse across the bottom. In this case the operator grips the scrotum firmly in his left hand, and, instead of pressing the testicles upwards, forces them down as far as they will go. The pressure of the left hand forces them through the incision, and they are drawn out one after another. This is probably the better method. Though it takes longer it gives a wether a more presentable appearance, a matter of some importance if the sheep is to be offered for sale. Instead of tearing the cord asunder, a blunt knife is sometimes used to divide it. The slight sawing action necessary prevents bleeding.

General Methods.

Where large flocks are concerned, it is necessary to carry out the work of "marking" on a different system. Usually both sexes are treated at the same time. But in some places it is customary for one man to castrate the males, while another does the ear-marking and tailing. If the tails of male and female lambs be kept separate, they form a useful means of checking.

The choice of a suitable site is the first consideration. The place chosen should be perfectly dry and well away from dust and dirt. If necessary, temporary yards should be erected for the purpose. The sheep should be mustered some time before, and the lambs allowed time to settle down before operations commence. There should be no rushing about, and dogs should be used as little as possible. Many deaths from hemorrhage are due to operation when the lambs are in an excited and over-heated condition.

In castrating, the operator should be on the watch for a male lamb with only one testicle. This is commonly known as a "rig." The tail should be left on to distinguish it, and the animal killed as early as possible; otherwise the remaining testicle may become functional, and the animal cause considerable loss and annoyance.

In all these operations, at whatever age they may be performed, the breeder should remember that if a little extra trouble and forethought will save the life of even one lamb this should more than repay him. It is only by securing the most favourable conditions in every respect that mortality can be reduced to a minimum.

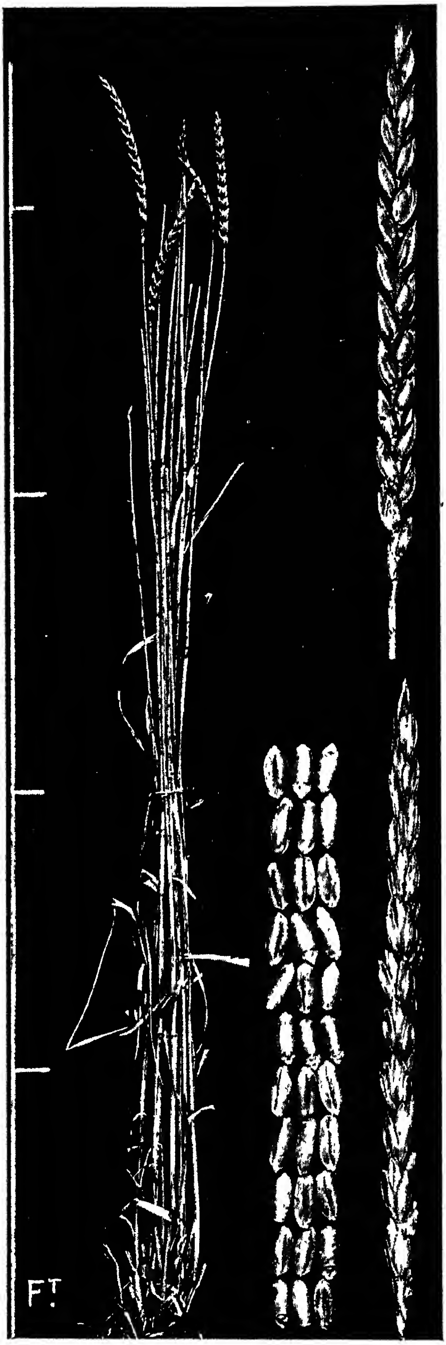


Fig. 18.—Zealand.

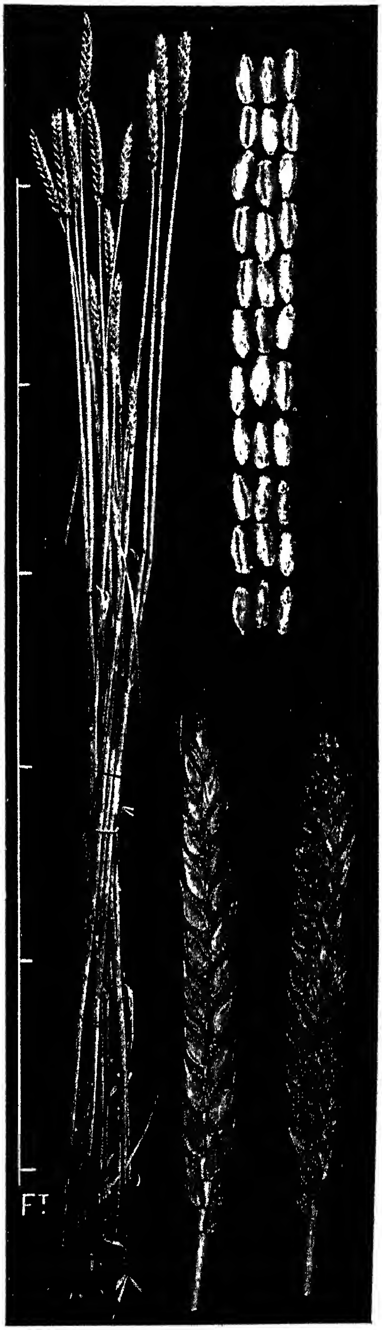


Fig. 19.—Bayah.

Varieties of Wheat recommended by the Department of Agriculture.

Fig. 20.—Cedar.

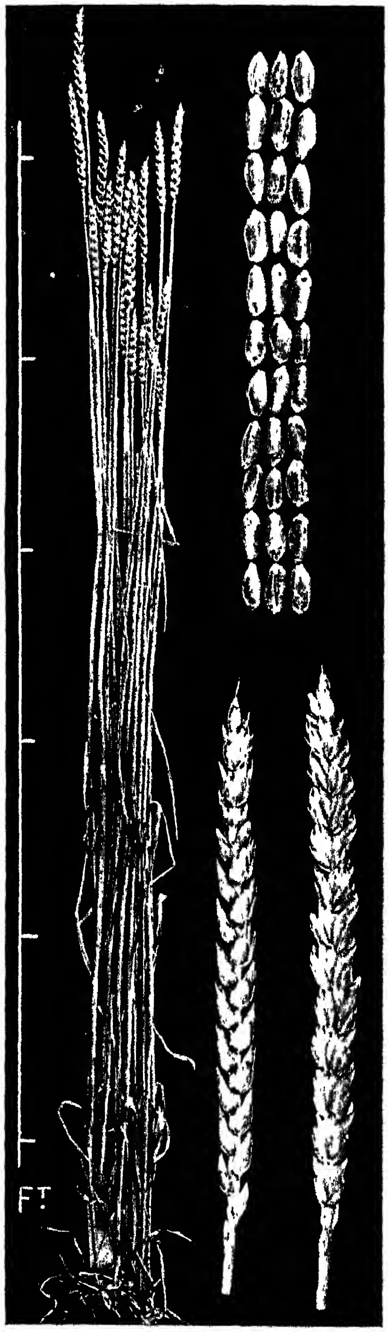


Fig. 21.—Genoa.

Varieties of Wheat recommended by the Department of Agriculture.

Varieties of Wheat recommended by the Department of Agriculture.

[Continued from page 288.]

GEO. L. SUTTON, Wheat Experimentalist.

Uppercut.

UPPERCUT is an erect-growing, early variety, which is of medium height, and which stools moderately. The colour of the young growth is dark, and very good. The quantity of foliage ranges from medium to light; the leaves are narrow and inclined to be stiff. When ripe the straw is white, and fairly stout. The ears are tip-bearded, of medium length, with the spikelets open and rather irregular. The chaff is smooth and adheres loosely to the grain. The grain is dull white, of medium size, and plump.

Uppercut was produced by crossing Nonpareil with Nutcut.

It is smut-liable, but highly rust-resistant, and because of this it is chiefly valuable as a variety for hay in districts where rust is to be feared. It is a satisfactory yielder of grain, and the grain yields a satisfactory quantity of flour, of good colour and medium strength.

Zealand.

Zealand is a tall-growing, free-stooling, late variety, of attractive appearance. The young growth is fairly vigorous, and its foliage colour dark; the leaves are broad, limp, and abundant. When ripe the straw is long, hollow, rather strong and stout, and yellowish in colour. The ears are beardless, long and tapering, with the spikelets rather open. The chaff is smooth and white. The grain is large, plump, soft, and dull white.

Zealand is an old-established variety, and is regarded as one of the very best varieties grown in this State for hay. For best results it must be sown early.

The manager of the Wagga Experiment Farm regards it as the most profitable variety for the conditions prevailing at that farm.

Zealand is also known as "Berthoud." It was originally imported from France, in 1888, by Mr. Geo. F. Berthoud, and grown by him in the Corowa district. Mr. Berthoud also grew another selection from a local variety which he called "No. 5." Mr. Farrer called this latter "Berthoud," to connect it with its selector. Subsequently he found that the differences between Berthoud and Zealand were so slight that they could be disregarded, and in consequence the two varieties were considered one and the same.

Under favourable conditions Zealand produces a satisfactory amount of grain, but for grain production it is being ousted by earlier varieties. This is especially the case as the quality of its flour is rather below the standard required by millers.

Fig. 7.—Haynes' Blue-stem.
(For letterpress description of this variety, see *Gazette* for April, 1910, page 282.)

Bayah.

Bayah is an early variety with short straw, and which stools moderately. The young growth is erect and compact, and its colour dark. The leaves are inclined to be stiff and broad, but are not abundant. When ripe the straw is stout, not very long, and yellowish white. The brown ears are very slightly tip-bearded, well tipped, and with the spikelets set closely together. The chaff is reddish amber, smooth, and sets close to the grain. The grain is white, soft, of medium size, and plump.

Bayah is a cross-bred, with the following pedigree:—

Improved Fife (a Manitoba variety) × Lambrigg Australian Talavera

Unnamed × Jonathan

Bayah.

With its short stiff straw, and brown, well-filled ears, this variety bears a very striking resemblance to Federation. It has only recently been placed into general cultivation, and has proved a good yielder of grain. It seems suitable for the same districts as Federation. Like Federation, it is unsuitable for hay, and very suitable for districts where the practice of stripping is general.

As a milling variety, it belongs to the "Soft White" class, but is superior to Federation, and under conditions where it is equally prolific it is desirable to plant it instead of Federation.

Cedar.

Cedar is an early variety, which stools moderately and which grows fairly tall. The young growth is spreading, and its colour is rather light. The leaves are not very abundant, are of medium length, narrow,

and inclined to be limp. When ripe the straw is whitish, long, and rather slender. The ears are beardless, tapering, with the spikelets not very close together. The chaff is white, smooth, and closely attached to the grain. The grain is red, hard, small, and fairly plump.

Cedar is a cross-bred, containing about three-quarters Manitoba and a quarter Indian blood, and has the following pedigree :—

Jonathan × Zaff (an Indian variety)

Power's Fife (a Manitoba variety) × Unnamed

Power's Fife × Unnamed

Cedar.

Cedar is highly rust-resistant, and is the most recent bunt-resister to be distributed for general cultivation. It is likely to prove bunt-proof. It will probably suit the districts of medium rather than those of scanty rainfall. It holds its grain so closely that it is difficult to strip or thresh, but is valuable on this account for districts where the conditions at harvest-time are unfavourable, and where the crop has to remain in the paddocks for long periods. It is a valuable hay variety, and in suitable districts it is also a prolific yielder of grain. As a milling variety it is amongst the best; it produces a satisfactory quantity of flour, of good colour, and very high strength.

The colour of the grain is red, and this prevents it being included in the "Strong White" class. It is rather entitled to be included with the Manitoba as "Hard Red." Mr. R. Patten, of Wellington, who grew this variety on a small scale last year, was offered 10d. a bushel advance on the market rates for this variety. The prospective buyer expressed the opinion that as the bran was *red*, horses would refuse to eat it. This is interesting,

Fig. 17.—Uppercut.

because the bran of nearly all the "Manitoba" wheats is red, and because a similar fear was at one time expressed regarding the bran of other Australian wheats because it was *not* red.

Genoa.

Genoa is a late variety, of medium height, which stools fairly thickly. The young growth is inclined to spread, and is of good colour. The foliage is not very abundant; the leaves are not very broad, and are inclined to be stiff. When ripe the straw is whitish, of medium length, and rather slender. The ears have a slight tip-beard, and are slightly tapering, with the spikelets fairly close. The chaff is white, smooth, and not closely attached to the grain. The grain is white, of medium size, round, and rarely plump.

Genoa is a full sister to Florence, which it resembles very much, but is later. Like Florence, it is bunt-resistant, and is possibly bunt-proof. It is more suitable for cool districts than for hot ones. In the latter districts it requires to be planted early. It is a valuable hay variety, the plant at flowering-time being green right down to the ground. As a milling variety it belongs to the "Soft White" class. It produces a large percentage of flour of excellent colour and satisfactory strength.

Huguenot.

Huguenot, or "Le Huguenot," is a very tall variety, which stools very sparsely. The young growth is rather compact and erect, and is of only a fair colour. The amount of foliage is moderate, with leaves which are broad and stiff. The straw is stiff, coarse, and solid near the ear. The ear is black, like that of Medeah, and is rather short, flat-sided, tapering at the ends, and beardless. The smooth chaff clings to the grain tightly. The grain is of the macaroni type, and is large, long, hard, fairly plump, and translucent.

Huguenot was originally found growing in a crop of Medeah wheat about 1898 by its introducer, Mr. J. Correll, of Beatzerring, Arthur River, Western Australia. It is supposed to be a natural cross-bred between Medeah and another variety, probably Purple Straw. From the number and character of the variations which have occurred since the original seed was planted, there is little doubt but that this variety is the result of a cross, natural or otherwise.

When originally sent out, its characters were not quite fixed, the majority of the plants being beardless, though some were tip-bearded. This feature is being eliminated by selection.

Huguenot is interesting because is is beardless, though it has all the other characteristics of a macaroni variety. It is both rust and smut resistant, and it is probable that a strain will be developed that will prove smut-proof.

It is valuable solely as a variety suitable for hay or ensilage, and it was for this purpose that Mr. Correll introduced it into general cultivation. On his farm it proved a very heavy and satisfactory yielder. Some heavy yields, up to 6 tons of hay per acre, have been also reported from South Australia. Under favourable conditions it will grow 7 feet high.

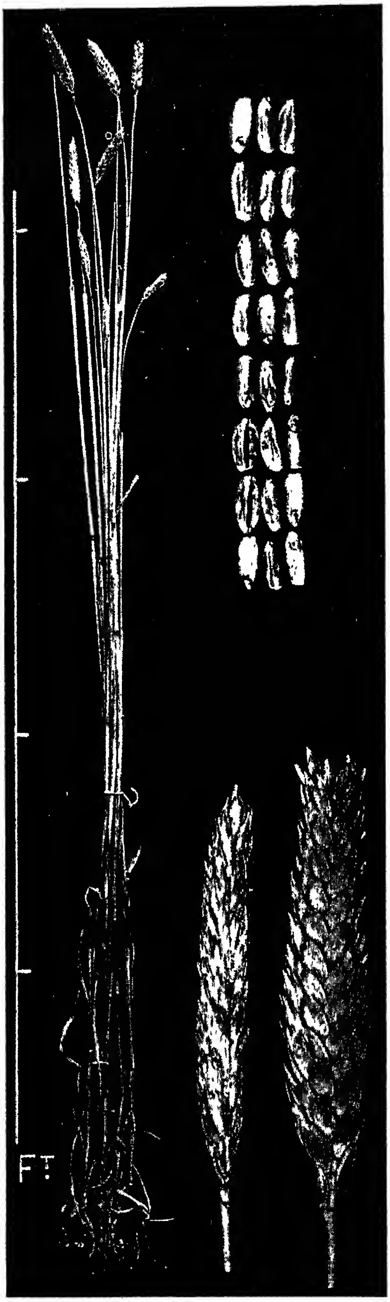


Fig. 22.—Huguenot.

Fig. 23.—Nutcut.

Varieties of Wheat recommended by the Department of Agriculture

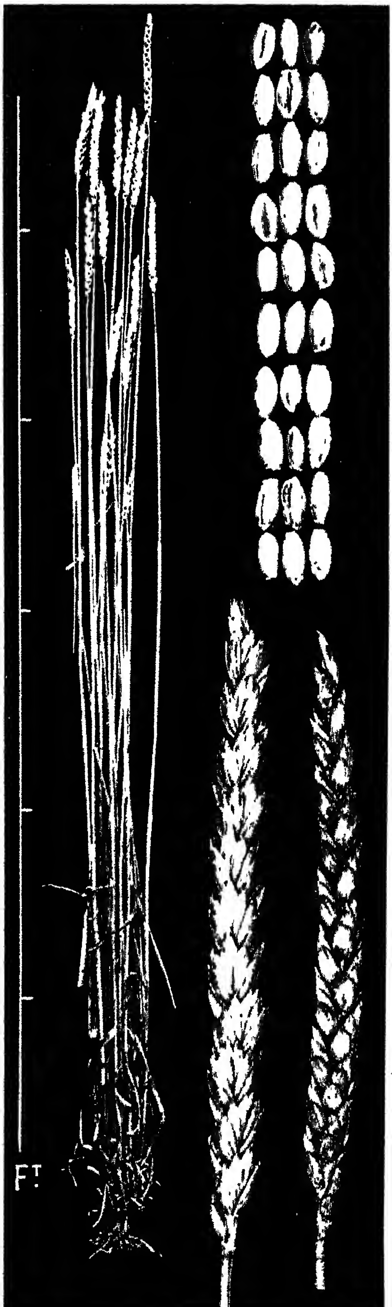


Fig. 24.—Warren.

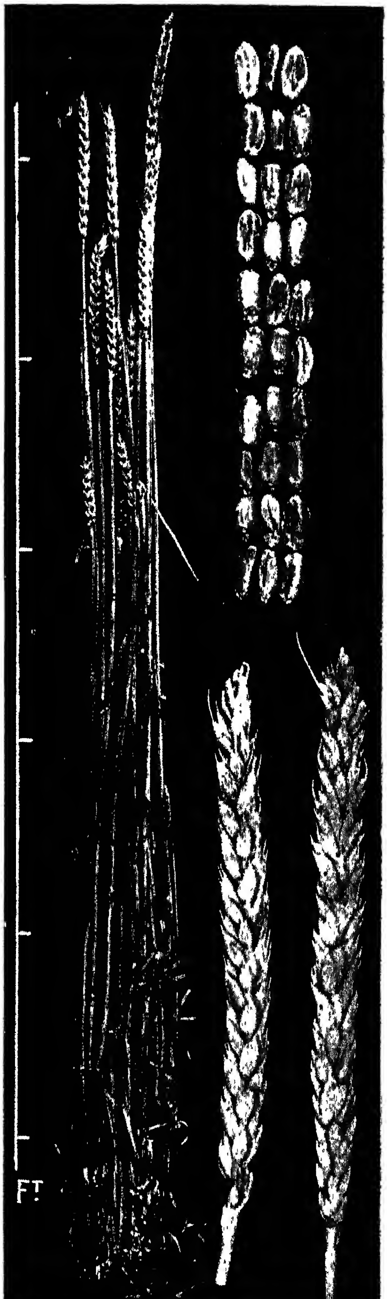


Fig. 25.—Yandilla King.

Varieties of Wheat recommended by the Department of Agriculture.

In the trials conducted in this State the results have not been as satisfactory, but this may to some extent have been caused through insufficient seed per acre being sown, for experience has since shown that this variety requires to be sown thickly, and probably at the rate of not less than 1 bushel per acre.

Horses are said to eat the stripped straw, which is stated to possess unusual sweetness when chewed.

As a milling variety it is remarkable for the large amount of gluten the grain contains. This ranges from 20 to 22 per cent., which is the largest amount found in any variety examined by Mr. Guthrie.

Its flour yield is very low, though its strength is high. The colour of the flour is so bad (almost black) as to make it useless from a miller's and baker's standpoint.

Nutcut.

Nutcut is an early variety, of medium height, which stools only moderately. The colour of the young growth is rather pale; the leaves are not abundant, and are half-erect and narrow. When ripe the straw is white, slender, and of medium length. The ears are slightly tip-bearded, of fair length, tapering, and with the spikelets inclined to be open. The grain is small, soft, white, and not very plump.

Nutcut is a cross-bred, with the following pedigree:—

Blount's Lambrigg × Indian G.

Australian Talavera × Unnamed

Nutcut.

Nutcut has proved very rust-resistant at the Hawkesbury Agricultural College. Its slender straw renders it very suitable for the production of high-class hay. It has not proved a prolific yielder in the grain districts.

The quality of the grain is excellent, producing a flour of splendid colour and great strength.

Warren.

Warren is a late variety, which stools well, and which in height is from medium to tall. The young growth is rather more prostrate than erect, of good colour, with the leaves fairly abundant, limp, and broad. When ripe the straw is white, stout, and rather long. The ears are beardless, long, tapering, and opening. The chaff is smooth, white, and set fairly close to the grain. The grain is long, white, and fairly plump.

Warren is the result of crossing Bobs with Jonathan, and then mating the progeny with another cross-bred called Warner.

Warren has proved a prolific yielder, almost wherever it has been tried. It is smut-liable, but has proved one of the best rust-resisters grown at the Hawkesbury Agricultural College, and is specially valuable for this quality. It is suitable for both hay and grain. In cool moist districts its straw is inclined to become weak. As a milling variety the quality of the grain is satisfactory. It yields a satisfactory quantity of flour of excellent colour, with a strength well above the standard.

Yandilla King.

Yandilla King is a free-stooling, late variety, of medium height. The young growth is inclined to be prostrate rather than erect. The leaves are a good dark colour, limp, and not very broad. When ripe the straw is white, not very long, and not very stout. The ears are slightly tip-bearded, fairly long, well tipped, the spikelets set rather closely together. The chaff is white, smooth, and fairly closely attached to the grain. The grain is white, large, and plump.

Yandilla King is the result of a cross made by Mr. R. Marshall, of Parkside, South Australia, between Yandilla and Silver King (the latter being also known as Marshall's No. 3 White Straw). It is interesting to note that Yandilla King is a half-sister to Federation, both varieties being the progeny of the common parent Yandilla. Yandilla is a cross-bred produced by Mr. Farrer, as the result of mating Improved Fife (a "Manitoba" variety) with an Indian variety called Etawah.

Yandilla King has proved a very heavy yielder in South Australia. During 1904 and 1905 it proved the most consistently heavy-yielding variety grown in that State. Since then Federation has contended with it for pride of place. It is a better hay wheat than Federation, producing a heavy crop of good-coloured hay. The milling quality of the grain is good, yielding a flour of excellent colour, and of a strength slightly superior to that of Federation. It belongs to the "Soft White" class.

Planting Potatoes.

Mr. C. Stanley Wilson, of Pymble, carried out some experiments last year in a small way to test several methods of planting potatoes. On an area 37 x 15 feet he planted fifteen rows, 2 feet 6 inches apart, each row having ten plants 18 inches apart in the row. These were divided into five sections of three rows each, in which the seed was planted as follows:—

First section—One eye only, with no flesh.
Second section—One eye only, with half potato.
Third section—Two eyes, with half potato.
Fourth section—Three eyes, with half potato.
Fifth section—Whole potatoes.

The best results were obtained from section 3—sowing two eyes and half the potato.

Similar experiments have been made by the Department and in other countries, and the results, though not uniform, have been to much the same effect. Cutting the tubers has the additional advantage of facilitating detection of unsound seed. The following advice is given in Bulletin No. 177 of the Agricultural Experiment Station of the University of Wisconsin:—

Too many farmers make the mistake of planting small potatoes. Where this practice is continued, it is bound to cause a deterioration or "running out" of the stock. Good average-sized potatoes should be planted. Cut the tubers to one or two eyes per piece. Pay more attention to the size of the potato than to the number of eyes it possesses, as good-sized pieces make a better start, especially if the soil is dry.

Notes on Wheats competing for Prizes at the Royal Agricultural Society's Show.

EASTER, 1910.

F. B. GUTHRIE.

THE number of individual exhibits competing in the wheat section of the 1910 Royal Agricultural Society's Show was forty-seven, exclusive of twenty samples entered for the special prize for the best collection of five Farrer wheats. This is the largest number yet entered, and is due to the considerably increased amount of prize-money allotted last year to this section.

The principal increases were in the medium hard and soft wheat classes, the entries for which were twenty-six and fifteen respectively, as against six and eleven in 1909. The large proportion in the medium hard class shows the increasing popularity of this type of wheat, which has also provided the special Champion Prize for the best bag exhibited for the past two or three years. A similar trend is shown by the fact that while the special prize for the best collection of Farrer wheats attracted four entries, the class for the best collection of wheat other than Farrer's was not represented.

The wheat Bobs again secured the first prize in its class and the championship for the best bag exhibited. This was a fine sample of milling wheat from Mr. Smith Pollock, of Quirindi, and yielded 24 bushels to the acre, with a bushel weight of 65¼ lb. The second prize in this class was also a Bobs.

In the soft wheat section Farrer wheats were also successful, the first and second prizes being taken by samples of Jade and Bunyip respectively.

On the whole, the samples exhibited were of a better class, and more attractive in appearance, than in previous years; though this remark does not apply to the hard Manitoba wheats, which were by no means such a good-looking lot as last year.

The judging was carried out as in previous years. The bushel-weight of all the samples was taken, and the results are given in one of the tables that follow.

After careful inspection to eliminate the inferior exhibits, those which were considered eligible for prizes were milled on the small model mill of the Department of Agriculture, the prizes being finally awarded in accordance with their behaviour in the mill, marks being assigned to the different

milling characteristics. These will be found in the table "Results of Milling Tests," in which table the figures within brackets give the actual milling results, the other figures giving the marks obtained.

The judges were Messrs. R. W. Harris, head miller Gillespie Bros., and F. B. Guthrie, Department of Agriculture, the milling of the samples being carried out by Mr. G. W. Norris.

Weights per Bushel.

Catalogue No.	Variety.	Weight per bushel. lb.	Catalogue No.	Variety.	Weight per bushel. lb.
		Class 711 (Macaroni).			
4559	Indian Runner	64	4560	Medeah	61½
		Class 712 (Hard or Strong Flour).			
4561	Manitoba	64	4563	Manitoba	60¾
4562	,,	58¾	4564	,,	62¾
		Class 713 (Medium Hard).			
4566	Comeback	65	4579	Comeback	64¼
4567	,,	64½	4580	Bobs	65½
4568	John Brown	62	4582	Comeback	66¼
4569	Barrota Wonder	64¾	4583	John Brown	61¾
4570	Comeback	62¾	4584	Budd's Early	66¾
4571	,,	67¼	4585	Bobs	65¼
4572	Bobs	64	4586	Comeback	65
4573	Comeback	63½	4587	Bobs	65½
4574	Bobs	63¼	4588	,,	60¼
4575	,,	62¾	4589	Comeback	64¾
4576	,,	64¼	4590	Bobs	65¼
4577	,,	63	4591	Towri Comeback	64½
4578	Comeback	64	4592	Comeback	65
		Class 714 (Soft or Weak Flour).			
4596	Federation	62¼	4605	Steinwedel	62¼
4598	Petatz' Surprise	66½	4606	Bunyip	63¼
4599	Jade	64¾	4607	Jade	64½
4600	Steinwedel	65¾	4609	Dart's Imperial	64½
4601	Cumberland	62	4610	Golden Drop	63½
4602	Dart's Imperial	65½	4612	Ward's Prolific	64¼
4603	White Lammas	64	4613	Farmers' Friend	62¼
4604	Bunyip	62¾			
		Special Class (Five Farrer Wheats).			
		Average.			Average.
4614		63	4616		62
4615		64¼	4617		63¾

Results of Milling Tests.

Catalogue No.	Appearance of Grain.	Weight per bushel.	Ease of Milling.	Percentage of Flour	Colour of Flour.	Percentage of dry Gluten.	Strength.	Total.
Maximum Marks.	10	15	10	10	15	20	20	100
Class 711 (Macaroni).								
4560	10	[62¼] 13	Difficult. 8	[67·2] 8	12	[11·5] 18	[48·5] 18	87
Class 712 (Hard or Strong Flour).								
4564	10	[62¾] 15	Fair. 8	[73·0] 10	13	[14·89] 20	[54] 20	96
4563	9	[60¾] 13	Fair. 8	[69·4] 8	15	[13·92] 19	[54] 20	92
Class 713 (Medium Hard).								
4585	10	[65¼] 15	Fair. 9	[75·6] 10	13	[16·93] 20	[51] 20	97
4590	9	[65¼] 15	Fair. 9	[71·5] 9	14	[12·89] 18	[50] 19	93
4573	8	[63½] 13	Fair. 9	[69·4] 8	13	[16·88] 20	[51] 20	91
4576	9	[64¼] 14	Fair. 9	[71·0] 9	15	[10·20] 16	[49] 18	90
4566	9	[65] 15	Fair. 9	[70·0] 8	13	[12·10] 18	[48] 17	89
Class 714 (Soft or Weak Flour).								
4607	10	[65¼] 14	Easy. 10	[72.5] 10	13	[12·98] 20	[48·4] 20	97
4606	9	[64] 13	10	[74·3] 10	15	[12·09] 19	[48] 19	95
4599	8	[65½] 14	10	[71·9] 10	14	[11·68] 18	[48] 19	93
4600	8	[66¼] 15	10	[70·6] 9	12	[11·57] 18	[47] 19	91

Awards.

Class 711.—Macaroni.
- First Prize, No. 4560, Medeah, W. G. Reinhard, Oddfield, near Wellington.
- Second Prize (not awarded).

Class 712.—Hard or Strong Flour.
- First Prize, No. 4564, Manitoba, W. G. Reinhard, Oddfield, near Wellington.
- Second Prize, No. 4563, Manitoba, D. McMillan, Orange Road, Bathurst.

Class 713.—Medium Hard.
- First Prize, No. 4585, Bobs, Smith Pollock, Quirindi.
- Second Prize, No. 4590, Bobs, Towri Estate, Maryvale.

Class 714.—Soft or Weak Flour.
- First Prize, No. 4607, Jade, G. Lindon, Gobbagombalin, Wagga.
- Second Prize, 4606, Bunyip, G. Lindon, Gobbagombalin, Wagga.

Champion Prize, No. 4585, Bobs, Smith Pollock, Quirindi.

Special Prize for the best collection of Five Farrer Wheats, No. 4617, Towri Estate, Maryvale.

Special Prize for the best collection of Five Wheats other than Farrer (no entries).

The following information, taken from the catalogue, regarding the prize-winning wheats will be of interest:—

Class 711.—Macaroni—

First Prize, No. 4560, exhibited by W. G. Reinhard, Wellington, New South Wales; variety, Medeah; grown at Oddfield, near Wellington, on red soil; sown at the rate of ½ bushel per acre; yield, 22 bushels per acre. Rainfall during growth of crop, 8 inches.

Class 712.—Hard or Strong Flour—

First Prize, No. 4564, W. G. Reinhard; variety, Manitoba; grown at Oddfield, Wellington, on red soil; sown at rate of ½ bushel per acre; yield, 16 bushels per acre. Rainfall during growth of crop, 9 inches.

Second Prize, No. 4563, D. McMillan, Bathurst; variety, Manitoba; grown at Orange-road, Bathurst, on red sandy soil; 45 lb. seed per acre; yield, 20 bushels per acre. Rainfall during growth of crop, 19 inches 83 points.

Class 713.—Medium Hard—

First Prize and Champion Prize for best bag of wheat, No. 4585, Smith Pollock; variety, Bobs; grown at Quirindi, on sandy soil; 45 lb. seed per acre; yield per acre, 24 bushels. Rainfall during growth of crop, 13½ inches.

Second Prize, No. 4590, Towri Estate, Maryvale; variety, Bobs; grown on Towri Estate, on red loam; 40 lb. seed per acre; yield, 26 bushels 32 lb. per acre. Rainfall during growth of crop, 11 inches 57 points.

Class 714.—Soft or Weak Flour—

First Prize, No. 4607, George Lindon, Wagga; variety, Jade; grown at Gobbagombalin, near Wagga, on shaly loam; 35 lb. seed per acre; yield, 24 bushels. Rainfall during growth of crop, 10 inches.

Second Prize, No. 4606, George Lindon, Wagga; variety, Bunyip; grown at Gobbagombalin, near Wagga, on shaly loam; seed, 34 lb. per acre; yield, 22 bushels per acre. Rainfall during growth of crop, 10 inches.

Dry Farming and Organic Matter.

At the suggestion of Mr. R. W. Peacock, manager of the Bathurst Experiment Farm, experiments are to be made at Nyngan and Wagga Farms on virgin soil to test the effect of ploughing only 4 inches deep, and stirring the subsoil from 2 to 3 inches. The surface will never be turned over to a greater depth than 4 inches. A check plot of the same extent will be ploughed in the ordinary way from 6 to 7 inches deep. All subsequent cultivation will be similar.

The object is to keep the organic matter within the first 4 inches, which Mr. Peacock considers will probably give better results than deeper ploughing, provided the subsoil be stirred to the equivalent depth of ordinary ploughing.

Our Experiment Farms.

J. E. O'GRADY.

COWRA.

Manager—Geo. L. Sutton.*
Assistant Manager—A. E. Darvall.
Registrar—[Vacant.]
Scientific Cadets { R. G. Downing, J. K. L. Murray.
Farm Foreman—J. W. Chapman.
Acting Experimentalist—F. Ditzell.

In 1903, as the result of a plebiscite of the ratepayers, 936 acres of land, about 2½ miles from Cowra railway station, were transferred by the Borough Council of Cowra to the Department of Agriculture for the establishment of an Experiment Farm. An attempt was first made to clear the land on piecework, but this proved a failure. The late Mr. Wm. Farrer, Wheat Expert of the Department, then selected 200 acres, which were cleared by contract. Some fencing was also carried out by contract.

In April, 1904, Mr. Geo. L. Sutton, Experimentalist at the Hawkesbury Agricultural College, was appointed Manager, and under his supervision the remainder of the fencing was done by contract. In these lines of fences arrangements were made to carry out a series of experiments. The orchard and vineyard were then laid out, and experimental crops planted. Hay sheds were erected by the farm employees, and tanks excavated by contract.

On the death of Mr. Farrer in April, 1906, Mr, Sutton was appointed as Wheat Experimentalist, in addition to his duties as manager of Cowra and Coolabah Farms. An assistant manager was appointed to Cowra. The stud wheats hitherto grown by Mr. Farrer at "Lambrigg," Tharwa, were transferred to Cowra; and it is the continuance of these all-important stud wheat investigations which gives Cowra Farm its prominence to-day.

The present buildings were completed in 1908, and are sufficient for the purely experimental work which has hitherto been done. Cowra is an experiment farm, even to the fences. Every operation is so conducted as to test some principle or proposal. But it has been decided that students are to come to Cowra, as to several of the other Farms, and additional buildings are necessary. The students' quarters have now been commenced, the materials used being cement blocks, made on the ground. The farmers of the district have been shown what can be done with pisé; the present construction is showing the value of concrete, which is, under suitable conditions for obtaining cement and sand, the very best material for the construction of substantial and attractive rural homes.

* Also State Wheat Experimentalist and Manager of Nyngan Experiment Farm.

Advantage is being taken of the young life of the farm to concentrate the buildings within a reasonably small radius. This, it is considered, will assist the management in combating the greatest danger of the district—bush fires. Already considerable damage has been sustained from this source. By having but one group of buildings to protect, the maintenance of fire-breaks will be simplified, and in case of an outbreak available resources may be more effectively utilised. The buildings are to be surrounded with a belt of walnut trees, which will be cultivated, and combine the dual purpose of an effective fire-break and a profitable crop.

For experiments in feeding, and also in breeding, some 500 sheep are kept on the Farm. Since the fire—14th December, 1909—no natural feed has been available, and these sheep have been sustained by grazing upon 16 acres of lucerne and the pickings from 80 acres of cultivation

Harvesting Experimental Plots with the Stripper, Cowra Experiment Farm.

paddocks. They are now feeding upon 32 acres of rape, with another 28 acres of barley ready for them to go on. This has been supplemented with ensilage from the silo. The district has been extremely dry since the beginning of this year, and some anxiety has been felt as to whether the soil of the farm would be moist enough to germinate the experimental plots of wheat. The orthodox methods of fallowing and cultivation are practised, and the disc plough and cultivator have been freely used. The ground at the end of April was covered by a fine, dry mulch, but beneath this, as the writer personally observed, it was quite moist enough to ensure germination.

An additional area of 50 acres, part of the town common, was recently added to the farm in order to facilitate the erection of rabbit-proof fencing, portion of the boundary being too rocky for this purpose. This gives a total area of just about 1,000 acres.

There are many points of interest about this Farm. One of the most instructive object-lessons is the silo. It is a tub-silo, built of Lachlan pine *(Callitris)* studding and flooring, lined with cement sheeting. It is bolted together and surrounded with wire ropes. There are no mortises, with the exception of the dividers in the continuous doorway. The foundation is one tier of bricks, and the silo is anchored by means of four concrete blocks let into the ground. It is 33 feet high, and has a nominal capacity of 150 tons. The longest piece of timber is 12 feet. The total cost of

Harvesting Experimental Plots with Reaper and Binder, Cowra Experiment Farm.

erection was £97; but had it not been for the newness of the work, and consequent unaccustomed labour, Mr. Sutton says the cost would not have exceeded £70 or £80.

Power for driving the stationary machinery is obtained from a 5 horse-power oil engine. The fixed plant includes chaff-cutter, elevator and grader, section grinder, and grindstone, and other machinery is being installed. The usual farm equipment of movable plant is included, except that the threshing-machine has been specially made to prevent admixture in dealing with the seed-wheat. The hay used on the farm is oaten hay; this is to prevent admixture of foreign varieties in the stud wheat plots, which might occur from the undigested grains if wheaten hay were used.

Chaff is not bagged at Cowra Farm, but elevated into a galvanised-iron bin, which protects it from mice, besides being more convenient and cheaper in handling.

The water supply for the Farm is obtained by means of an Alston windmill and elevated tank from a surface tank excavated in a suitable position near the buildings.

As has been observed, the whole of the operations at Cowra, even to the erection of fences, have been experimental. An idea of the nature of these field investigations and the results obtained may be gained from the following notes.

Experiments with Wheat.

I. The production of new varieties, which shall be nutritious, of high milling and baking value, specially suited for Australian conditions of cultivation, and, if possible, able to resist bunt, rust, take-all, aphides, and disease generally.

This is the continuation of the noble work of the late Mr. Farrer, work which has added many thousands to the profits of Australian farmers, and which has attracted the attention of scientists, wheat-growers, millers and bakers throughout the world. On the death of Mr. Farrer, Mr. Sutton was appointed to continue this work, and Cowra Farm has the honour of being the chief field of operation. The section also includes the testing of introduced varieties of wheat.

About thirty cross-bred wheats have been fixed by Mr. Sutton, and are being tested at the different Experiment Farms of the Department. Some half-dozen of these have been fixed at Cowra. These varieties are not named, and will not be named unless and until they have proved superior in some respect to existing varieties. Until then they are simply registered under a number. As soon as a variety is fixed it is tried at all the Government Farms, and if it proves satisfactory sufficient seed is raised for distribution to farmers.

Any new varieties, the merits of which are not already known, are tested in the stud plots at Cowra, and, if they are found worthy of further trial, they are then planted in the field plots. A complete test of any variety is made, including its suitability to the climate, milling value, and resistance to disease. This work is special in its character, and requires that each grain be dropped singly by hand, so that each plant occupies a given and regular area.

The breeding plots at Cowra Farm occupy about 10 acres of the cultivated area.

II. To determine—(1) The most seasonable time to plant a wheat crop; (2) the most suitable amount of seed to use; (3) whether the direct application of simple or compound fertilisers is beneficial when the supply of organic matter in the soil is kept up.

These experiments are now in progress. So far, the indications are that May is the best month for planting wheat at Cowra; that 40 to 45 lb. of seed

per acre give best results; and that the application of fertilisers is not necessary when the soil is kept well supplied with organic matter.

III. To determine—(1) The comparative effect upon the resulting crop and upon the texture of the soil of the disc and mouldboard types of plough—(*a*) with subsoiling, (*b*) without subsoiling; (2) the comparative effects upon the resulting crops of—(*a*) deep ploughing, 8 inches, (*b*) medium ploughing, 6 inches, (*c*) shallow ploughing, 4 inches; (3) whether the direct application of a suitable wheat fertiliser is necessary or profitable with these depths of ploughing.

Incidentally the results of these experiments will confirm those of II (3).

With regard to the two types of plough, there is very little difference between the results obtained, and the experiments so far indicate that either plough may be used without risk. Six-inch ploughing seems to be the most profitable depth; and the indications are in the direction that the application of fertilisers is not necessary for wheat at Cowra, when the ground is in good heart.

IV. To determine the effect upon the fertility of the soil of the various methods of harvesting, viz.:—(1) Stripping and burning the straw; (2) stripping and ploughing the straw in; (3) harvesting with reaper and binder.

Each of these methods is being tested with wheat crops grown continuously; with wheat grown after a bare fallow; and also with wheat after a rotation crop such as rape or tares. The effect of fertilisers is also being tested in this connection.

When wheat is grown continuously, so far stripping and burning the straw for the first few years seems to be the most economical practice.

With regard to the methods of harvesting a wheat crop grown in a rotation, no conclusions have yet been formed; but it seems probable that the same returns will be obtained with wheat after a fallow crop as with wheat after the less profitable bare fallow.

The effect of fertilisers in the continuous wheat section is, as would be expected, a marked success; but so far the benefits are not at all marked where a rotation is practised.

V. To determine the suitability of different varieties for grain and hay when sown—(1) Early; (2) mid-season; (3) late.

The lesser-known introduced and new cross-bred varieties are tried in the stud plots, and if they show promise the experiments are carried to the field. The most promising varieties for this district so far have been Federation, Bunyip, and Comeback.

VI. To determine the effect upon the milling quality when the grain of the same variety is harvested at different stages of maturity, commencing at waxy stage and finishing at dead ripe.

No results of value have yet been obtained, but the experiment is proceeding, and similar trials are being conducted under the supervision of the Wheat Experimentalist at the other Farms.

VII. To determine the effect of feeding off wheat crops when planted early, mid-season, and late.

So far the results point to the fact that crops sown before the middle of May, in an average season, ought to be fed off.

VIII. Experiments with wheat and fungicides are made each year at Cowra, and the effect of each fungicide tried upon the seed and upon the resulting crop is ascertained.

The results are published annually, and in the *Gazette* for May, 1910, page 382, where the tests made in 1909 are dealt with, full particulars of the methods adopted will be found. The results for last season have induced the authors to recommend the addition of salt to the bluestone solution as a farmer's treatment for the prevention of smut.

Oats.

The suitability of different varieties for hay and grain is tried at Cowra, and so far Algerian has proved unquestionably the best variety for the district. The work of the production of new varieties has been in abeyance for two or three years, but, it is hoped, will be resumed in the near future.

Miscellaneous Crops.

Variety and comparative trials are made of summer and winter crops to test their suitability for rotation with wheat. Rape, cowpeas, sorghum, and Canada field-peas have proved suitable, and tares partially suitable for this purpose.

Fertilisers.

Last year experiments were commenced to determine the availability and agricultural value of the different commercial sources of plant-food. No results are, of course, available yet.

Sheep.

Trials are being made to determine the relative values of various merino crosses as wool producers, and also as mothers for the production of cross-bred lambs; to ascertain the most profitable lamb to raise for marketing as a weaner, using various British breeds as sires, mated with merino and cross-bred merino ewes; and also to determine the relative merits of these latter crosses for the production of mutton and wool. Of course, results in this regard are not yet available from such a new establishment as the Cowra Farm.

Fences.

The most suitable distance apart to place fence posts; the most efficient and economical dropper to use; the relative efficiency and economy of plain and twisted wires—these are simple, practical points on which much money has been saved or lost in New South Wales. They are all being tried at Cowra.

Concrete fence posts have been found to be efficient and very satisfactory, as explained in the *Gazette* for April, 1909, page 314. Experience has proved the truth of the opinions expressed in that article.

Demonstration plots of native and exotic grasses have been planted at Cowra for the information of the farmers of the district; and half an acre has been set apart for the use of Mr. F. B. Guthrie, Chemist of the Department, who is about to commence some experiments in connection with nitrification of soils.

This is a summary of what is being done at Cowra, with interim results; probably enough has been said to justify the action of the Department in establishing an Experiment Farm here, in the growing heart of the wheat-belt. Visitors to the Farm will find it in a transition stage, owing to re-arrangements rendered necessary by the proposed introduction of students; but a wheat man will find much to interest him, and after seeing the attention given to the stud wheat plots at Cowra, with their fine tilth of light red granitic loam, will rest confident that the Department will not allow the name of William Farrer and the great work which his death left half completed to become mere memories of the past.

Contributions to the Farrer Memorial Fund.

Name.	Address.	Amount. £	s.	d.
Amount received up to 23rd May, 1910 ...		507	2	4
Messrs. Brunton & Co., flour millers	Clarence-street	10	10	0
Bathurst A. P. and H. Association ...	Bathurst ...	5	5	0
Messrs. Wise Brothers, flour millers	54 Pitt-street, Sydney ...	2	2	0
Mr. Rowe	Currabubula	0	5	0
Mr. D. Klempsch	Germanton	0	4	0
Mr. W. Brown ...	Gunnedah...	1	1	0
Mr. G. S. Lipscombe ...	West Maitland ...	1	0	6
Sir Matthew Harris ...	Sydney	2	2	0
Master Bakers' Association ...	Sydney	5	5	0
Messrs. Tremain Brothers, flour millers	Bathurst ...	2	2	6
Messrs. Paton, Burns, & Co., manure merchants	Sydney	1	1	0
Mr. C. G. Scott ..	Avoca-street, Randwick	1	1	0
Mr. A. Muggridge (Messrs. Pitt, Son, and Badgery) ...	Sydney	1	1	0
Mr E. D. Donkin	Mandamar, Barmedman	1	1	0
Mr. S. Eardley-Wilmott	Fiona, Brisbane-st., Launceston	3	3	0
Mr. G. A. Richards	College-street, Drummoyne ...	0	10	6
Y.M.C.A. (Double Quartette)	———	0	8	0
Rev. G. Thompson	Windsor ...	0	10	0
Mr. Frank Guest	Kurrajong	1	1	0

Name.	Address.	£	s.	d.
Mr. E. Heane	Dappo, Narromine	1	1	0
Mr. Frant Coffee	4 Castlereagh-street, Sydney	1	1	0
Mr. J. E. O'Grady	Department of Agriculture	0	10	6
Sydney Chamber of Commerce	Sydney	10	10	0
F. and S. Association	Glen Innes	1	6	0
Mr. W. S. Arnold	Kurrajong	0	10	0
Mr. A. Darvall	Ryedale, Ryde	1	1	0
Mr. J. H. Keys	Bengalla, Muswellbrook	1	1	6
Mr. Frank Mack	Narromine	2	2	0
Mr. Frank Osborne	Yarramine, Neutral Bay	1	1	0
Mr. B. C. Meek	Bathurst	2	2	0
Mr. E. O. Warburton	Warburton's Wharf, Pyrmont	1	1	0
Mr. G. Leonard Brown	Weenya, Gular	1	1	0
Mr. R. T. Vyner	Loxton, Wandsworth	2	2	0
Mr. C. F. Tindal	Ramornie Station, Copmanhurst	0	10	6
Mr. R. A. Ellis	Witheron, Bothwell	1	1	0
Mr. Otto Ballhausen	Department of Agriculture	1	1	0
Mr. D. M. Bell	Baerami, Denman	2	0	0
Mr. F. Malley	Mosman	1	1	0
Mr. George Marks	Department of Agriculture	2	2	6
Mrs. Chisholm	Wollogorang, Breadalbane	3	3	0
Mr. Allen Piggin	Corowa	1	1	0
Mr. George Stening	Department of Agriculture	1	1	0
Mr. C. M. Mills	Co-operative Dairy Co., Denman	0	10	6
Mr. F. C. Wright	Aboomala, Guyra	1	0	0
Mr. A. H. Warner	Warner Estate, Wyong	5	5	0
Mr. H. Craven	Preston, Waverley	2	2	0
Mr. C. H. Bate	Mountain View, Tilba Tilba	0	10	6
Mr. V. E. Greeves	Balmoral, Mullaley	1	1	6
Mr. R. G. McKillop	Buddah, Narromine	0	10	6
Mr. A. V. Lillyman	Bunvidoon, Moree	2	0	0
Mr. W. A. Flider, baker	Armidale	0	10	0
Superior Public School	Granville	0	6	0
P. A. and H. Association	Cowra	10	10	0
Mr. J. W. Ritchie	Burringbar, Tweed River	1	0	0
Mr. H. Barlon	Denman Dairy Company, Denman	0	10	6
Mr. J. W. Hadfield	Hurlstone College, Summer Hill	0	10	0
Mr. A. H. Haywood	Department of Agriculture	0	5	0
Mr. F. C. Rudd	Campbelltown	0	5	0
Mr. John Cameron	Maclean	2	0	0
Mr. H. Rogers	Nyngan	1	1	6
Mr. P. G. Hampshire	Department of Agriculture	0	10	6
Mr. H. McLeich	Yea, Victoria	1	1	0
Mr. A. Buttner	Currajung, *via* Rosedale, Victoria	0	10	0
Mr. C. Bossley	"Tosca," Richmond	1	1	0
Messrs. Anderson & Co., seedsmen	Sydney	5	5	0
Messrs. J. T. and H. C. Tod	Fawsley Park, *via* Goondiwindi, Queensland	1	1	0
Mr. C. A. Buchan	Milton	0	5	0
Mr. L. G. Phillamy	Cookardina	1	0	6
Mr. W. R. Fry	Department of Agriculture	0	10	6
Mr. J. D. Richardson	Raymond Terrace	0	10	6
Mr. W. G. Lee	Wagga Experiment Farm, Department of Agriculture	1	0	0
N.S.W. Co-operative Bakers' Association	Sydney	5	0	0
Total amount received up to 21st June, 1910		£633	19	10

Barren Sands, Vine-growing, and the Phylloxera Question.

M. BLUNNO.

About three years ago phylloxera was found at the State Viticultural Station, Howlong, on nine vines which for certain comparative experiments had not been grafted on phylloxera-resistant stocks. It then became imperative to establish another similar institution in a clean district, and, if possible, under conditions which would make it impossible for this pest to ever attack vines or stocks planted thereat.

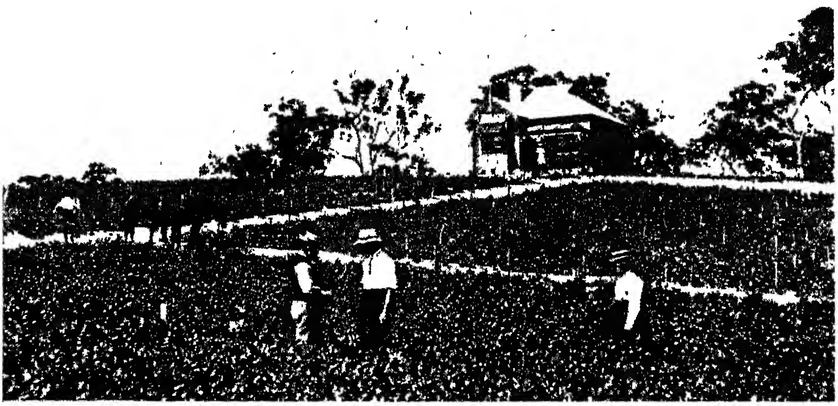


Fig. 1.—Hunter Valley Viticultural Station.
Nursery in the foreground; collection of table grapes on the right, mother stocks on the left, up the hill. Two rows of cowpeas are planted between the vines in the vineyard section.

Needless to say, as soon as those nine vines were found infected at the Viticultural Station, not only was the whole block of about 250 vines eradicated and the ground disinfected with bisulphide of carbon, but eight more blocks of equal size were similarly destroyed, these being pendent to plots of vines grafted on phylloxera-resistant stocks for the purpose of study. Although an examination of the rootlings of resistant stocks reared in the nursery revealed no traces of the pest, still the Department stopped cuttings and rootlings from being sent by that institution to districts as yet presumably free from phylloxera, and the available supply all went to districts like the counties of Cumberland and Camden, the district of Corowa, and the parishes of Thurgoona and Newton, near Albury, where this pest is known to exist.

On the other hand, vignerons and intending vine-growers located in country where phylloxera has not made its appearance are anxious to prepare

for the time when the pest may break out among their plantations, and they apply for a supply of resistant stocks. It is obvious, in such cases, that the vine-stocks should be clean beyond any shadow of doubt; hence the necessity for the Department to establish another viticultural station, where such clean stocks could be raised. It is well known that any vineyard, whether of ordinary vines or of vine-stocks, grafted or ungrafted, is liable to catch phylloxera, which may enter by various channels. A Government vineyard is more likely to become so infected than a private one, because the Government, for the progress of the industry, must now and then import new varieties of grapes from foreign countries. Having taken all this into consideration, the only solution was to establish the new Viticultural Station in very poor, sandy country.

Why in very poor, sandy ground? Because phylloxera cannot live in a sandy soil. But there are sands and sands.

Sands in France.

At Aigues-Mortes, in the Camargue and other districts on the Mediterranean shore of France, there are sands in which many thousand acres of European vines not grafted on phylloxera-resistant stocks have enjoyed immunity from this pest for the last thirty-five years. It was on the initiative of a small vine-grower, M. Bayle, that large tracts of dunes were put under vines in the Gard district, the example being followed in the Gascoigne and in the alluvial sands of the Rhône Valley. M. Bayle did not discover the immunity of sands to phylloxera, for there were already in the Aigues-Mortes plains over 1,250 acres under vines out of the 15,000 comprised in the territory so called; but it struck him and several others that although the scourge had swept like fire through all other vineyards in all other sorts of ground, those 1,250 acres were still unaffected and flourishing. No one dreamt then that the whole of the delta of the Rhône, which grew stone-pines, or was nothing but a very inferior pastoral country harbour for flamingoes, or in full ownership by buffaloes, would become a source of a great fortune for several vine-growers.

It was in 1869 that Bayle first thought of the matter; thirteen years later Aigues-Mortes was one whole vineyard, and the price of land in that malaria-infested country rose to £180 sterling per acre. The two small sleepy country towns of St. Louis and Philippe le Hardy emerged from their lethargy as two brisk, busy, prosperous communities. After this all the littoral country, from Fos to Narbonne, where the sands, impregnated with salt, would grow nothing but a few weeds scantily and sparsely, was planted with vines. But before vines were planted the sandy country was cut up, and portion after portion submerged several times, to wash out the salt.

The southern coast of France is not the only part of that country where vineyards exist in dunes. At Cape Breton vines have been planted into dunes for many years; authenticated records prove that since the first half of the fifteenth century those wind-exposed sea-sands have grown grapes.

An old French law regarded these vineyards, not as real property, but as *proprieté mobilière*—that is, personal property—because the mobile sands, gradually shifting by the wind, half buried the vines that had been planted on the slopes of the dunes. Then these vines, although several years old, were lifted and transplanted in another portion of the dunes which the winds had not yet scoured. In more recent times, however, the inconvenience arising from the wind has been obviated by means of shelter trees, and thus the eastern sides of the dunes, which are in preference transformed into vineyards, are well protected. The wines made there are very delicate and worthy of note, and the white ones are of a beautiful topaz colour. Those sands are composed of 98·8 per cent. of fine quartz sand and 1·2 per cent. of fragments of shells. As this paper deals only with the immunity from phylloxera which favours vines in very sandy soils, I shall not touch on the quality of these wines, which is generally known to be of the best.

Fig. 2.—Hunter Valley Viticultural Station.
Mother stocks in foreground; second section of nursery in centre; mother stocks again up the slope.

Sands in Hungary.

Nor is France the only country where what were practically desert sands have, in a few years, as if by the touch of a magic wand, smiled into oases of green, into beehive-like centres of activity, into eldorados of contentment and cornucopiæ of abundance and wealth. At the Viticultural College at Farkasd, in Hungary, experiments were conducted in 1883 to prove the immunity of sandy soils from phylloxera. Four vine rootlings, with their roots literally covered with phylloxera, were planted in pots filled with sand. The rootlings were potted on the 4th August, and on the 22nd of the same month the young vines were lifted and closely examined, and the pest had disappeared. Since then a huge tract of territory, from the foot of the Carpathian Mountains on the Servian frontier, extending for miles south-

ward, and composed of spewing sand-waste, gradually became covered with vineyards. The Government encouraged the enterprise by enacting the Law XVII, 1883, by which the new plantations were exempt from land tax for the first six years. Since then these and other sand wastes in Hungary have been reclaimed, and, by annual growing of lupins as green manuring, have acquired a great fertility.

Sands in Italy.

Dr. C. Grimaldi was the first in Italy to find that there were sandy soils in the country that enjoyed immunity from phylloxera, and in 1888 he directed the attention of experts to the resistance to this disease of the vineyards between Pozzallo and Pachino, in Sicily. In some sections of that part of the country clay emerges; in others, over the clay there is a deep layer of sand blown from the sea; and in others still the clay and sand are mixed. Till 1885 all that zone was clad with vines; but then phylloxera came, and all the vineyards where the clay emerged fell a prey to the parasite; whilst all those planted where there was a deep layer of sand over the clay resisted, and are still alive. In the plantations where clay and sand were mixed, the vines resisted more or less according to the relative proportions of the two ingredients—the larger the proportion of sand the greater the resistance.

Somewhat similar is my personal experience of a case in this State. Near Ingleburn, in the county of Cumberland, there is a vineyard of about 5 acres that at the time belonged to one George Groat. The inspector of the Department, visiting vineyards in order to detect phylloxera, discovered eighteen infected vines in this vineyard. On my going to the place to verify the inspector's report I found that the eighteen vines were all in one corner of the plantation. All the vineyard was in sandy soil, which was very deep, and covering a layer of clay; this layer of clay, however, towards that particular corner, ran fairly close to the surface, and the grower hand-trenched that corner before he planted his vines. In trenching he mixed the top layer of sand with the bottom layer of clay. Here phylloxera got a hold, while three careful and close examinations, with intervals of six and twelve months, revealed no trace of phylloxera in the remainder of the vineyard. That vineyard, after the lapse of over ten years, is still standing and in bearing, minus the three quarters of an acre where the sand and underlying clay had been mixed in the trenching by the grower, which this Department, on my recommendation, ordered to have eradicated in pursuance of the "extinction method" then adopted in dealing with phylloxera.

At the Viticultural Conference held at Catania in 1890 Grimaldi exhibited several vines which he had lifted from ground where clay and sand occurred in alternated thin layers. Those vines showed very neatly that all the roots running in the clay layers were badly infected with phylloxera, while those running in the sand layers were healthy and clean. The Italian Government directed the Royal Institute of Miners to study the sand formations of the kingdom, and samples were taken at various places and analysed at the Royal Agricultural Station in Rome. Several sand forma-

tions have been found throughout the country of four degrees of resistance. In the province of Caserta there are sands of the first degree; in the same province and in those of Lucca, Pesaro, Roma, Cagliari, and Syracuse, there are sands of the second degree; while sands of the third and fourth degrees are found in small quantities everywhere; in such sands vineyards may be attacked, and their resistance more or less pronounced. The writer, when a student, visited a vineyard near Gallipoli, on the Gulf of Taranto, established in dunes. The owner, a Monsieur Adrien Auverney, redeemed a marshy malarial zone on the coast by gradually filling the swamps with the sand from the dunes. The top of the dunes was disturbed at intervals, and the wind blowing from the sea carried the sand and raised the level of the low-lying land. In this sand he planted a splendid vineyard.

The Aigues-Mortes sands, in the south of France, which have become classical throughout the world as an example of immunity from phylloxera,

Fig. 3.—Hunter Valley Viticultural Station.
Mother stocks in foreground on left, with second section of nursery beyond. Mother stocks on the right.

are of the second degree, whereas, as mentioned above, there are sands in the province of Caserta that are of the first degree. The standard does not consist only in the relative proportion of sand to the other mechanical ingredients, but the size of the grains, their roundness of shape and levigation are also to be considered. Vine-growing countries, in view of the great ravages that phylloxera makes wherever it penetrates, should cause a study to be made of their sand formations.

Sands in Northern Africa.

The sea-sands on the coast of Tunis, those of the Sahel in the Algerian territory, and the old reddish sands of the Quaternary period between Guyotville and Sidi-Feruch, have been utilised for vine-growing, not excepting several localities along the Suez Canal!

Why are Sandy Soils Immune?

The late Professor Marion was one of the first to look into the question of the immunity of vines in sandy soils, and to try to find the scientific reason of it. His experiments of bringing to his experimental station in the Bordeaux district several tons of the Aigues-Mortes sand with which he filled a big hole, dug in a clayey soil, conclusively proved that that sand had lost nothing of its properties by being removed from the place where it had lain for ages. In fact, he planted a number of vine rootlings so badly infected that the roots had quite rotted; still phylloxera soon disappeared, and fresh clean roots grew. These experiments led then to the practice of digging a fairly large hole around infected vines and filling same with fine sand. The method answered well, but, as it may be imagined, was a very expensive undertaking, especially where the sand had to be carted from a great distance. Hence it was soon dropped.

Experiments scientifically conducted, and a long experience derived from extensive cultivation of vines over large territories of sandy soil, have long ago proved, not only that phylloxera, when carried by wind, or by any other accidental means dropped on a plantation in sand, cannot find its way to the roots, and therefore perishes; but also that if infected vines are planted in such sands they, after a month, free themselves from the parasite, and even if the roots have been totally destroyed new healthy roots will spring from the butt. Professor Marion thought that sands were possessed of the faculty to act as an insecticide; how, he could not say. Others believed that the edges of the sand grains caused wounds on the body of the parasite; that the alkaline salts contained in the sea-sand acted as poison; or that the mobility of the sand was an obstacle to the very small parasite, which could not travel from point to point. Various other theories were also advanced, until Vannuccini, of Italy, demonstrated that this faculty of sandy soils is due to their great permeability to water and capillarity. He showed that sandy soils which are apt to get too dry, either because the rainfall is scarce or because there is no water relatively close to the surface, have no such immunity. Vannuccini took micrometic measurements of the interstices between grain and grain in a suitable sandy soil, and found that the space was sufficient for young phylloxera to move in, but when it had reached its adult stage it would be closed in on all sides. If, then, a supply of moisture rises from the lower layers, or comes from the surface by rain, the small aphis finds itself enveloped by a thin vein of water, and its respiration is endangered. This was merely a hypothesis which he advanced, but he proceeded to prove it experimentally.

He filled with sea-sand three conical glass vessels. In the sand he buried pieces of vine-roots infected with phylloxera. In one of these receptacles the sand was left in its dry condition, just as it was when collected. The second was watered once till the water ran through and off the bottom of the vessel, and then was watered no more. The third was similarly watered, but the watering was repeated daily for eight days. At the end of this period Signor Vannuccini examined the roots. Those from the first vessel

were alive; the pregnant mothers had laid their eggs and these had hatched, the young insects having fixed themselves on the roots not distant from their respective mothers. The roots from vessels numbers 2 and 3 showed on the contrary that the insects had lost all vital activity; no new eggs had been laid, and those that had been laid just prior to being put in the sand had not hatched, and had lost their bright sulphur-like colour, which had changed to a dull brown. The sudden dropping of the temperature which must have taken place in the two vessels that had been watered cannot explain the change, because the three vessels were all kept in the laboratory, where the temperature was fairly high; and the three vessels having been covered, all evaporation was prevented. The temperature could not therefore have varied much in the three receptacles. The cause affecting the phylloxera could only have been the water impeding the breathing, as explained above. This theory is corroborated by the application of that peculiar remedy to eradicate phylloxera from a vineyard, *i.e.*, the submersion of the vineyard for from six to eight or nine weeks in winter time, keeping a layer of water 8 inches to 10 inches high without interruption, and repeating the process every year.

A natural corollary to Vannuccini's theory is that a sandy soil, to remain immune and proof against phylloxera, must be always moist, either through frequent rainfalls or through irrigation, or by the presence of water fairly close to the surface. The great capillary power of sand keeps the layers within which the vine-roots expand in the necessary condition of moisture. Such conditions prevail in all sandy soils on the Mediterranean and Atlantic shores and in the Hungarian territory referred to, on account of a number of swamps with which the territory is dotted. Elsewhere, at a certain depth under the sand there is a claypan with a very gentle fall, and the rain-water, even if scarce, is quite sufficient to keep the required degree of moisture. Vannuccini's theory was accepted by Marion and Barral, who simultaneously studied the matter, and at present no one disputes it.

There are sandy soils in the counties of Cumberland and Camden of different degrees of fineness, and varying in the relative proportion of that ingredient to the other mechanical constituents. Generally speaking it is alluvial sand, in several cases of greyish colour owing to a small proportion of silt matter. Although the vineyards around, which were in stiff soil, have mostly disappeared one after the other, on account of phylloxera, vineyards on these sands are still in existence, and luxuriant.

Fineness of Sands endowed with immunity to Phylloxera.

The sands that have proved to possess highest resistance or absolute immunity are formed of fine even grains, round and well levigated, with a diameter ranging from $\frac{1}{200}$ to $\frac{1}{50}$ of an inch. They must be siliceous sands—*i.e.*, of the nature of quartz. They must also have a fairly continuous supply of moisture, either rising from below by capillarity or by being in a district where rain is not too scarce. The colour of the sand is not much to go by, for there are resistant or immune sands grey, reddish, or pale yellow.

The bigger the grains the lower the resistance, especially if they are very sharp. The sharper the sand the weaker and more uneven the action of capillarity, because a number of interstices remain unfilled with water, and in these phylloxera find enough air to breathe. The minimum proportion of sand of the kind already described that a soil should contain is from 60 to 70 per cent., provided that the balance is not all made up with an ingredient of binding nature like clay. A rough-and-ready way of judging whether a sandy soil is likely to be resistant or not is to damp it, and then press some of it between the tips of the fingers, afterwards placing it on a board. If the shape soon crumbles that soil is sure to resist. The information given above should be borne in mind by those who have sandy soils, because often some think that their ground is sandy, when really it is sandy loam. I have seen a vineyard right on the left bank of George's River, near Liverpool, where the sandy soil was well impregnated with fine black silt; the vines there all perished through phylloxera, and the vineyard has been reconstructed since with resistant stocks of the Riparia and Riparia x Rupestris types, which grow splendidly. Another vineyard on the right bank of the same river, near Casula, was in a sandy soil also impregnated with silt, but the sand was of fairly big grains, and very coarse and sharp. When fairly wet several grains would bind together and form small lumps. Phylloxera was found on several vines scattered throughout the plantation.

How to prepare sandy ground before planting.

From the foregoing it naturally follows that when a layer of suitable fine sand only, say, 12 inches deep, rests on a subsoil formed by coarser sand, sand mixed with clay, or mostly clay; or *vice versa* when the suitable sand is underneath a heavier surface layer; in breaking that ground the surface layer alone should be ploughed; and if it be desired to disturb the subsoil, then the subsoil should only be broken with a subsoil plough, so as not to mix sand and clay. The sand layer, if it be on the surface, will act as a protector, not allowing phylloxera to reach the heavier ground underneath; and if it be below the surface layer it will allow the roots to grow there within a non-infected medium; in fact, all the roots will be found there, and none on the surface.

It is evident from this explanation that the quality and quantity of sand in a soil are the cause of resistance, and in many cases of immunity; also that in the case of sands enjoying immunity the proportion of the other soil ingredients is so small as to render necessary good manuring to increase and maintain their fertility. Vines throw their roots far, wide, and deep, so they feel much less the poverty of a soil. River sands are always richer than sea-sand, for, in the first instance, there is a quantity of silt, which, however, may lessen more or less the resistance of the sand. The sands of the Rhône Valley, in France, have all been planted with vines, and some of them for nearly thirty years have defied phylloxera.

The best and immediate results in the south of France were given by those sands that had been under cultivation for some time before, the madder

being the chief plant grown till the vines transformed all that barren country.

One would naturally think that, in view of the lightness of sandy soil, it should hardly be necessary to break up and disturb the ground to any great depth. The late Professor Foëx, Director of the Viticultural College at Montpellier, pointed out that ploughing and then subsoiling are of the greatest importance, and have much influence on the future of the vineyard, and he advised subsoiling as deep as 20 inches. He goes further still, and would have men following the subsoiler and shovelling out *pelleversage*—the deeper layer of the sand—to fill the next row, thus putting the surface layer at the bottom, and *vice versa.* The opinion of M. Foëx is of great weight, for, apart from being the most eminent authority in viticulture up to the time of his lamented death five years ago, he was connected directly or indirectly with the utilisation of those sand dunes at Aigues-Mortes and in the Camargue. He also points out that the accumulation of humus, consequent upon the successive cultivations of madder and a few other plants that preceded the vineyard, did not in any way impair the resistance or immunity of those sands. Applications of stable manure or of oil-seed cakes are very strongly recommended for such sandy soils, without any fear of altering their mechanical texture, and naturally, chemical fertilisers are also most effective.

The Hunter Valley Viticultural Station.

Near Raymond Terrace the Department initiated the establishment of a viticultural station in very sandy country, about 8 miles from Stockton beach. Possibly the site in the ages gone by was a series of dunes, in which gigantic eucalypti have since so grown as to transform them into a very thickly-timbered country. They are well above the low-lying land around; thus a supply of moisture continuously rises to within three or four inches from the surface, apart from a good rainfall which may be relied upon. The country intervening between the shore and the site is well wooded, and acts as a break-wind—the wind there not blowing any more strongly than further inland; less strongly in fact than on the Hunter River flats. The main difficulty encountered has been in connection with the clearing, because of the very heavy timber and undergrowth with which the country is covered, the roots having attained enormous size and having extended far and wide, thus making the expense of grubbing unusually heavy. It being necessary to establish a vineyard and a nursery, the roots had to be run down to a far greater depth than is usually done when preparing ground for crops.

Broom Millet.

Probably the first shipment of Australian-grown broom millet from this State to America was made per s.s. "Manuka" to San Francisco on the 9th May last. The millet was grown by Mr. Stephen Holden, of Ghinni Ghinni, Manning River, and was shipped by Mr. John M. Moy, of 161, Sussex-street, Sydney.

Egg-laying Competitions at Hawkesbury Agricultural College and Experiment Farm, Richmond, New South Wales.

Eight Years' Data.

Improved Average Results.—Lessons Learned and Applied.

D. S. THOMPSON, Poultry Expert.

The egg-laying competitions organised by the *Daily Telegraph*, and conducted at the Hawkesbury Agricultural College, concluded another year on 31st March, 1910.

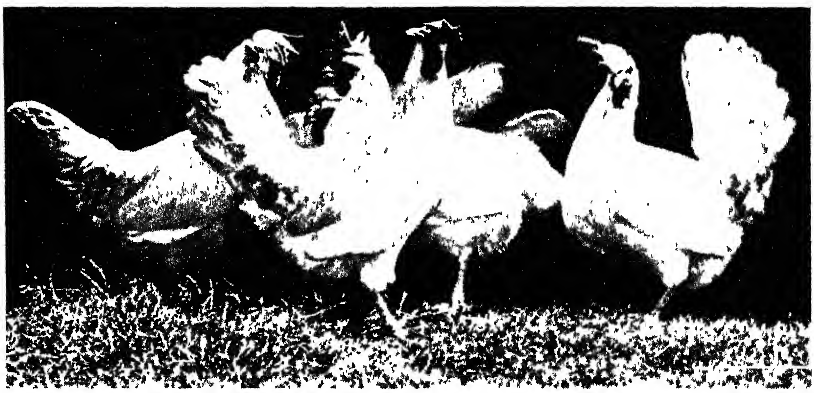


Fig. 1.—Mr. F. J. Brierley's Winning Pen.

The average results of both the annual and two-years' tests show a continued advancement, which bears evidence to the fact that the educative influence of these competitions is still manifest in promoting the breeding of poultry of greater productiveness, and consequently of greater profitableness. The lessons which poultry-keepers have learned, and are still learning, in the direction of the choice of the best commercial breeds, and the selection of breeding stock and layers, are gratifying features that are again brought into prominence.

The general system of feeding and management, which has for several years proved so successful, has not been departed from. The results of the first duck test do not compare favourably with those from the fowls. The first-year hens, for instance, returned a profit of 15s. each over the cost of

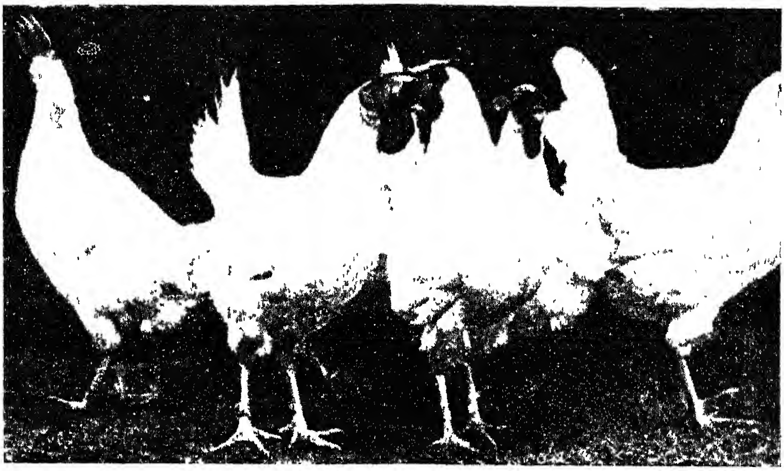


Fig. 2.—Mr. S. Ellis' Pen. Champion Cup for Stamina, the Original Six Hens Laying for Two Years without the Replacement of a Bird.

Fig. 3.—Single Bird in Mr. F. J. Brierley's Winning Pen.

Fig. 4.—Single Bird in Mr. S. Ellis' Pen, Winner of the Champion Cup.

feed, which is a 25 per cent. better financial result than in the best of the previous seven competitions. The second-year hens gave a profit of 9s. 8d. each, while the ducks were each only 7s. to the good.

Fig. 5.—Mrs. F. L. Snowdon's Pen, Third Prize for Greatest Number of Eggs.

The committee, in pursuance of their policy to make the competitions increasingly instructive, has arranged to break new ground in the tests. Thus ten of the pens of two-year hens have been re-entered for a third year's test. This will be the first of the kind ever attempted in the world, and is confidently expected to yield valuable results. Ten of the pens of pullets in

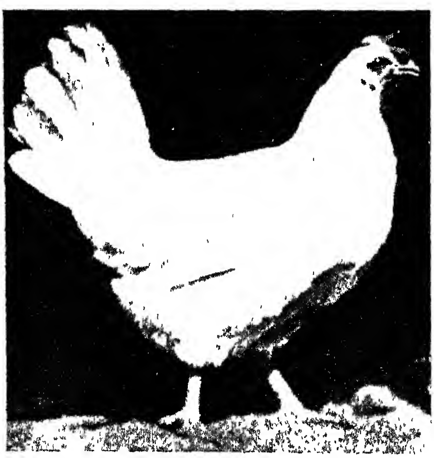


Fig. 6.—Single Bird in Mrs. F. L. Snowdon's Pen.

the ninth annual competition will be fed on the dry mash system, and in this way a reliable comparison will be obtained of its value with that of the ordinary methods.

The executive management was in the hands of a committee, consisting of Messrs. H. W. Potts (Principal of the Hawkesbury College), D. S. Thompson,

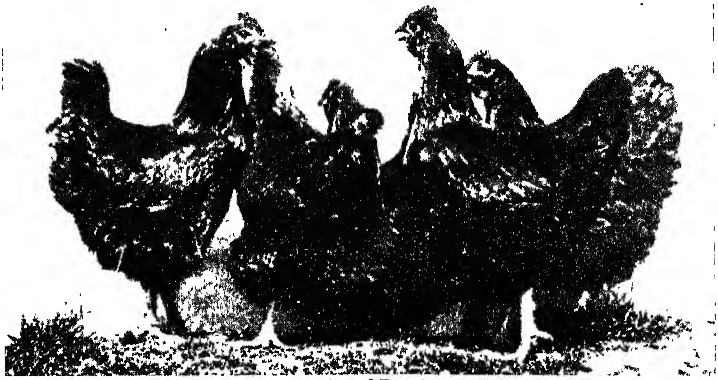


Fig. 7.—Mr. F. Herps' Pen, Greatest Number of Eggs in Second Year, and Winner of Winter Test for Hens.

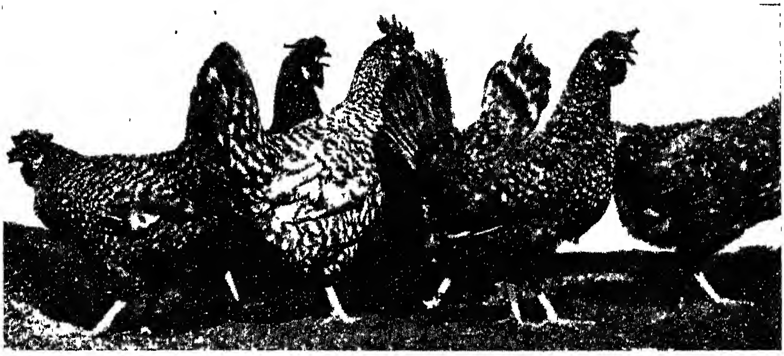


Fig. 8.—Mr. W. Mitchell's Pen, Second for Greatest Number of Eggs in Second Year Contest.

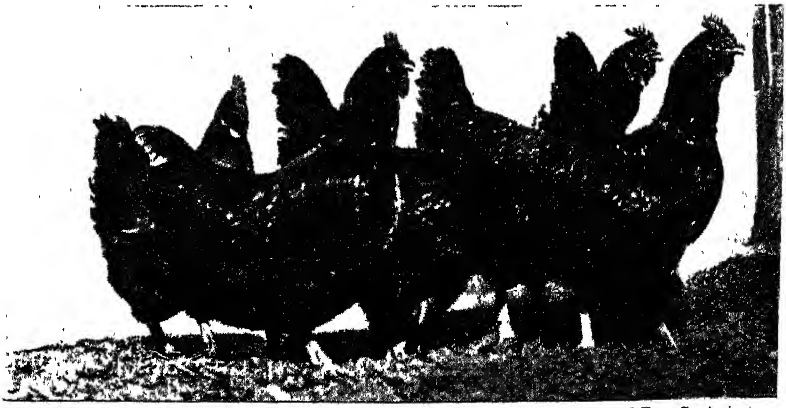


Fig. 9.—Mr. A. E. Henry's Pen, Third for Greatest Number of Eggs in Second Year Contest.

S. Ellis, W. T. Ely, A. E. Henry, L. L Ramsay, E. Waldron, and A. A. Dunnicliff, Junior (*The Daily Telegraph*). Liberal cash prizes were given, amounting to £131, and including £50 donated by the *Daily Telegraph*.

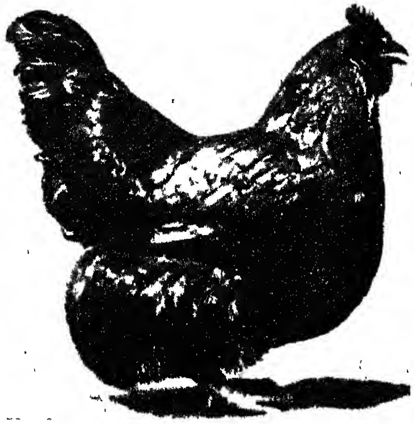


Fig. 10.—Single Bird in Mr. F. Herps' Pen.

GENERAL REVIEW.

The whole series of tests has been a continued success, the eighth competition surpassing all its predecessors in the general average of eggs produced. In the first test the average laying of the 38 pens competing was 779 eggs, and by a process of evolution of better strains, better breeding, better selection, and better feeding this number has been gradually increased until the present test gives an average per pen of 1,089 eggs, or an increase of 310 eggs, representing an advance of 40 per cent. Surely this is something for the promoters and for the breeders to be proud of. It should be a great incentive to keep on, for there is every justification for the expectation of still further raising the average production. The results undoubtedly confirm the theory of better breeds, better strains, better profits. Not only in the pullets has there been an appreciable increase, but also in the second-year hens, the third test eclipsing the two previous ones. The increase per pen is well over 100 eggs, showing that the improvement in egg production in the pullets is sustained in the second year.

The Lessons Learned.

The completion of the eighth year of this experimental work confirms the conclusions arrived at and published in previous years. While the making of new data is of great value, the question of the data being sustained is of greater value. There is no doubt that this accounts for these competitions having so much value throughout the world, in comparison with other tests and experiments, which are only conducted for short periods, from which hasty conclusions have been drawn and given out to the world.

The data produced here and confirmed year after year are of great importance to the State. They include :—

Fig. 11.—Single Bird in Mr. W. Mitchell's Pen.

The demonstration has been given that egg-production will pay well.

That poultry farming can be conducted on small areas.

That it can be made to pay even by purchasing all food.

That good strains of good breeds are the most profitable, and will respond the most quickly to selection for intense egg-production.

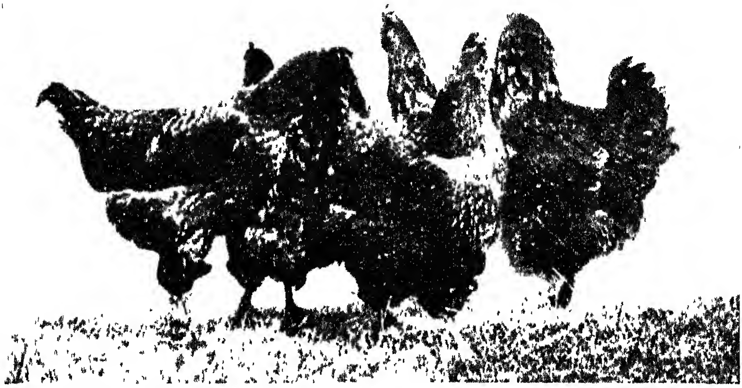


Fig. 12. Forest Home Poultry Farm's Pen, Second for Winter Test for Hens.

That the White Leghorns, Black Orpingtons, and Silver Wyandottes are the best breeds, and that the fewer the number of breeds used for commercial poultry farming the better will be the improvement attained. This question is in itself of vast importance. From a chaotic list of innumerable breeds, in which the embryonic poultry farmer was lost in bewilderment, the list is now a very short one, and the prospective poultry farmer has no trouble in making a selection.

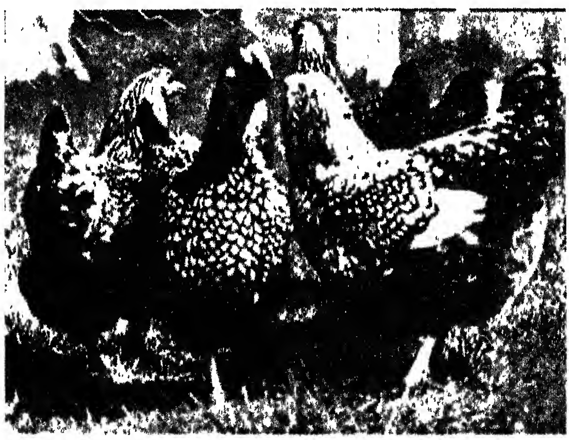


Fig. 13.—Mr. L. A. Herdegen's Pen, Third for Winter Test for Hens.

The story of skimp feeding or the danger of over-feeding layers has been exploded, and a method of full and plenty has been substituted with very much improved results.

That, while a varied diet is the best, maize in a fair proportion can be fed profitably to poultry.

That divisional pens will give the best results, it being far better to divide a lot of 100 into ten pens than to leave them all together.

The competitions are fulfilling the desire of the promoters and committee, in that they have been a source of education to poultry-keepers, the great majority of whom are still just as ardent students as ever.

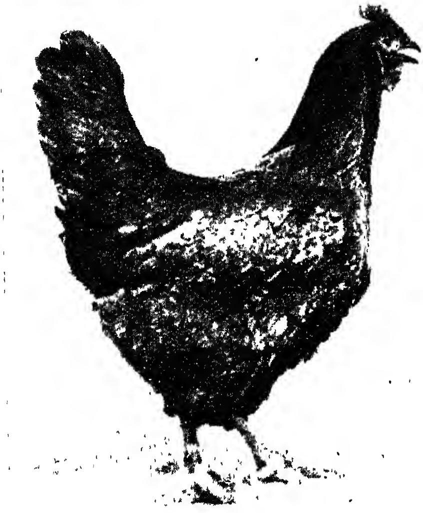


Fig. 14.—Single Bird in Forest Home Pen.

The whole of the tests have been carried out on plain, practical lines within reach of the ordinary farmer. Plain houses, plain yards, and plain feeding, and there is general satisfaction to all concerned that the methods employed have formed a standard basis for the whole Commonwealth.

Fig. 15.—Single Bird in Mr. L. A. Herdegen's Pen.

The Weather Conditions.

Throughout the first part of the test the weather continued very dry, and, following on a number of dry years, the effects of the drought were most marked. By the end of last year the pens were almost denuded of grass, and for a time little or no green food

was available, so severe was the drought. Splendid rains fell, however, in January and February, and in a very few days after the first fall there was a splendid shoot of grass, which the hens were not slow to appreciate. The growth was too fast for them, and now the grass is a foot deep in most of the pens. The season right through the test has been favourable to egg production, and in favour of the Leghorns, which took full advantage

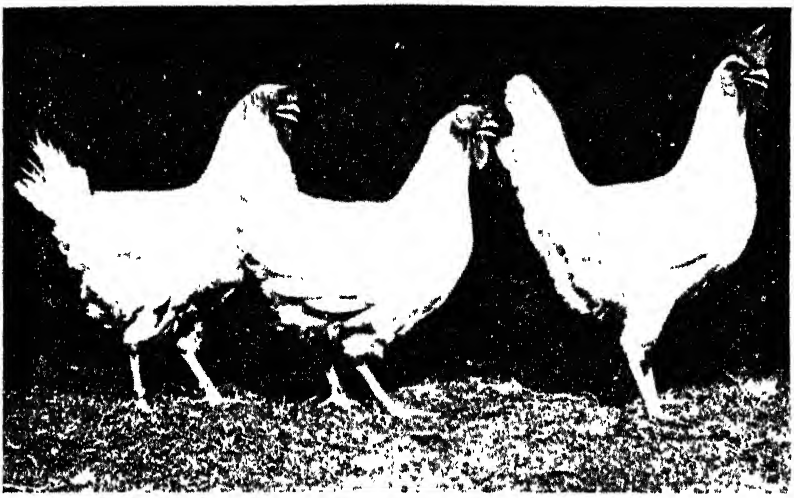


Fig. 16.—Three of Mr. R. H. Stewart's White Leghorns.

of it by pretty well carrying off all the honours. Although these tests have run eight years, they have only demonstrated what can be done in dry seasons, and how the various breeds will lay under such conditions. The natural assumption is that this has favoured the Mediterranean breeds. As to whether this is actually the case is a question of great importance, and one that can only be definitely solved by a cycle of wet years.

Fig. 17.—Mr. T. Partridge's Pen, Second for Greatest Number of Eggs in the First Year Contest.

Foods and Feeding.

Although so much has been written on feeding in connection with these tests and otherwise, the subject is an evergreen one. It is one of primary importance, and cannot

be too fully dilated upon. The natural grasses in a run form the greater proportion of the food consumed by fowls; consequently good grass runs is half the battle in poultry-farming. At times of the year when the grass gets withered off in dry seasons, or by frosts in the winter, the poultryman must supply the deficiency by growing green feed of some sort, and lucerne, clover, and rape are preferred. It should be chopped or finely cut up.

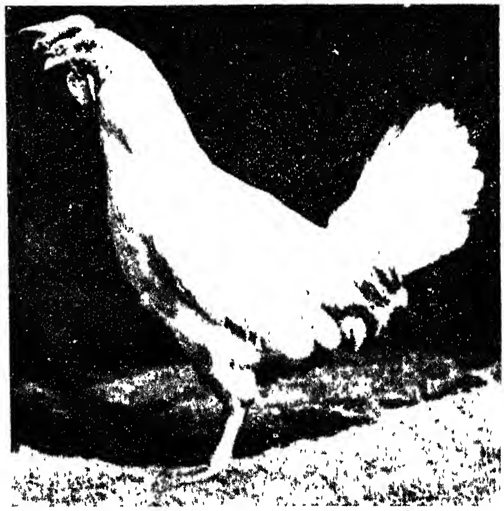


Fig. 18.—Single Bird in Mr. R. H. Stewart's Pen.

At 7 a.m. the fowls are fed with mash, composed of one-quarter bran and three-quarters pollard Since the tests have commenced the proportion of bran has been diminished and that of pollard has been increased, as we are satisfied the stiffening comes from the pollard. These measurements are in bulk, not in weight.

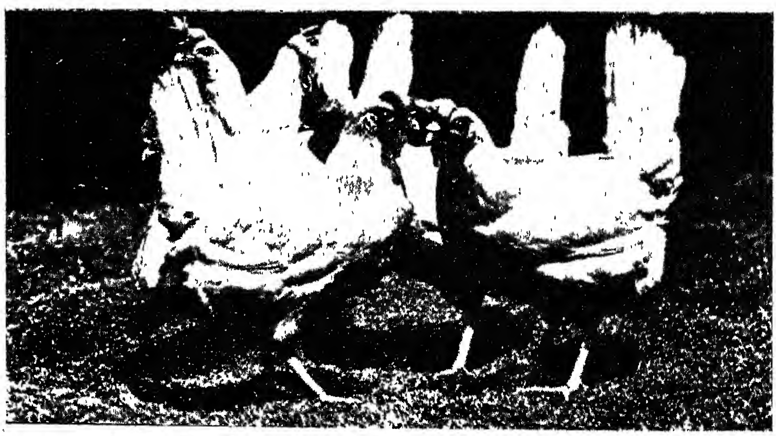


Fig. 19.—Range Poultry Farm's Pen; Third for Greatest Number of Eggs from Pullets in First Year Contest and Third for Winter Test.

The mash is mixed up in the winter months with boiling water, and in the summer with cold. Twice per week only, both summer and winter, the mash is mixed up with the minced bullocks' livers (about 60 lb.), and the boiling hot soup therefrom. On no

consideration would we depart from this method, so long as the meat is reasonably procurable. The controversy that has been in progress on the question of the necessity or otherwise of meat feeding for laying hens can be solved or settled by the tyro or the layman by striking the "happy medium." These tests have amply proved that meat

Fig. 20. - Single Bird in Mr. T. Partridge's Pen.

fed in the way described here is undoubtedly beneficial, and conduces to extra profitable egg production. On the other hand, it has been just as clearly proved that the prospective poultry farmer need have no fear of starting in the business, even if he cannot obtain

Fig. 21.—Single Bird in Range Poultry Farm's Pen.

meat supplies, as was unquestionably the belief in years gone by. Like all other staple foods for poultry the cost should always be the qualifying question, and we have no hesitation in stating that the poultryman who can obtain meat supplies readily, and at a reasonable price, should do so.

The birds are fed gross—that is, they have more fed to them than they will eat up clean, just at the time of feeding. With the skilled poultryman the surplus will have disappeared within two or three hours of the time of feeding. It is wonderful the difference in the appetites of the hens on the mornings of the meat mash compared with

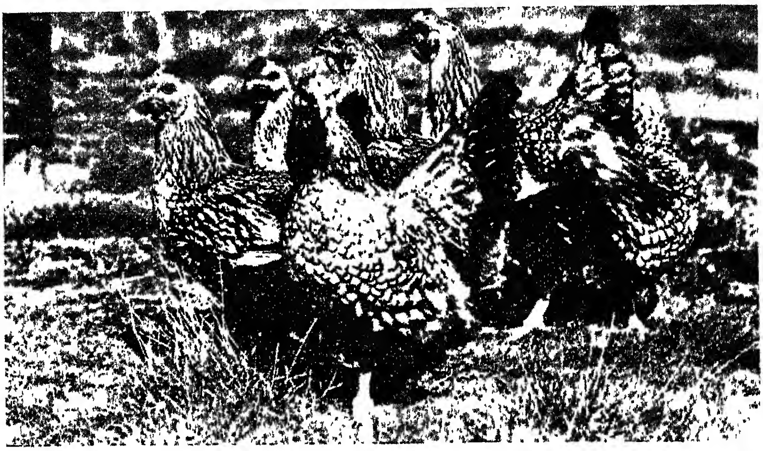


Fig. 22.—Mr. R. Maxwell's Pen, Winner of Winter Test for Pullets in First Year Contest.

the mornings of the ordinary mash. A good deal of indifference is shown to the no-meat breakfast, and the eagerness for their meat mash is very striking by way of contrast. The grain feeding in the evening consists of wheat, principally, throughout the summer,

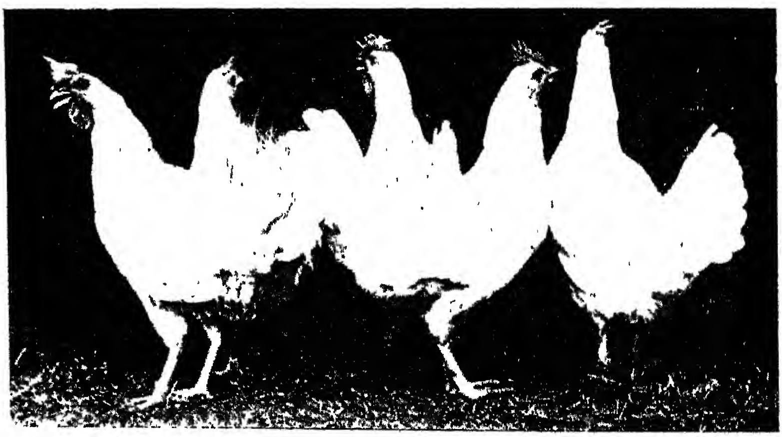


Fig. 23.—Mr. A. R. Browne's Pen.

with crushed maize for a change. For cold weather and damp spells, the crushed maize predominates. The grains are fed heavily, but an imperial pint, more or less, is pretty near the quantity required for six well-fed hens. Hens eat most when just coming on to lay, and secondly, when laying, the quantity of food lessening as the egg production falls off. Plenty of sea-shell grit is all that is required for grit and lime feeding.

The Ducks.

The ducks have been fed at the same time as the fowls, but on mash each time, one-third bran to two-thirds pollard, and green stuff at midday. No meat was obtainable, and consequently none was given. There is no doubt, in my opinion, that the

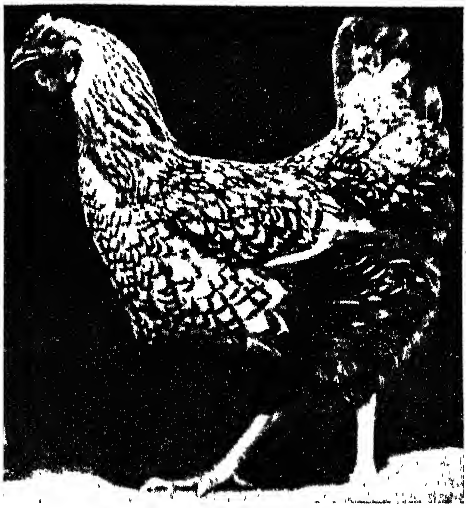


Fig. 24.—Single Hen in Mr. R. Maxwell's Pen.

feeding of soup and meat in the mash, the same as was done for the hens, would have given us better egg returns. The results we regard as very fair considering the conditions, and no doubt they will be improved upon year by year. One thing which I

Fig. 25.—A White Leghorn, from the Pen of Mr. A. R. Browne, Second Prize for Winter Test for Pullets in First Year's Contest.

believe militated against the best results was that many of the ducks were too young to lay in April, May, and June. One-half of them were not laying until June. This shows the necessity of breeding for earlier laying in April and May, when prices are more profitable.

Mortality and Disease.

In the whole eight years there has been no sign of any infectious deadly disease. I say deadly, because there has been plenty of evidence of scaly leg, which is infectious, but, while very unsightly, is not deadly. Even scaly leg is becoming less and less

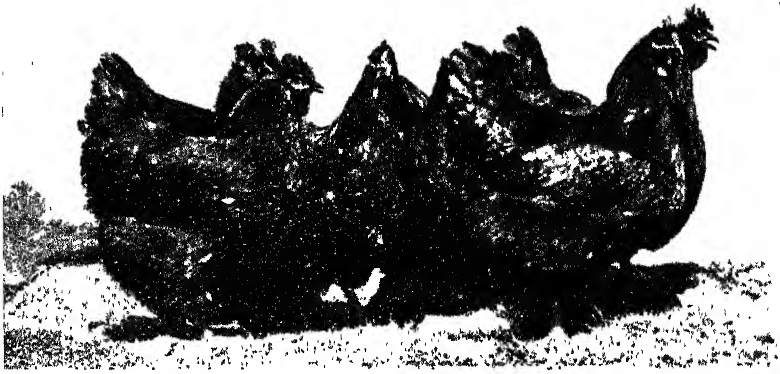


Fig. 26.—Mr. A. R. Kennedy's Pen, Winners of General Utility Prize. Total Weight of Six Hens on 1st March, 1910, 41 lb.

evident every year, showing that all Asiatic fowls' legs should be dressed with kerosene emulsion two or three times while pullets. I verily believe that if this were systematically done by all breeders, and it could easily be done, the disease would disappear. The mortality comes almost entirely from ovarian causes, and has been normal. A death

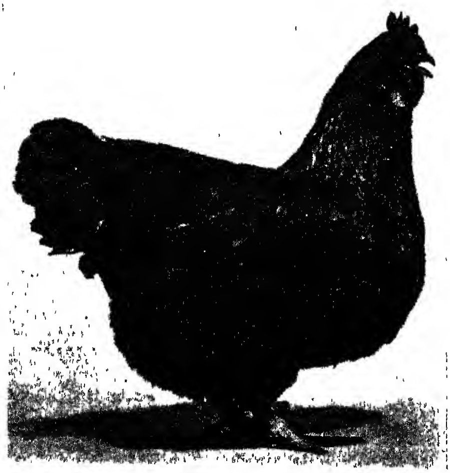


Fig. 27.—Single Hen in Mr. A. R. Kennedy's Pen.

roll of seventeen pullets out of 360 shows only 5 per cent. mortality, and thirteen old hens out of a total of 240, gives about the same percentage. The number of deaths among the 150 ducks was 12, or 8 per cent. The cause of the death of the ducks was entirely ovarian.

THE TWO-YEARS' TEST.

The improved results obtained in the third two-years' test stand out as the conspicuous feature of the year's work. The performance of Mr. F. Herp's Black Orpingtons during the second twelve months is especially noteworthy.

The Prize-winners.

The prize-money amounted to £50, and was won as follows,—

Greatest number of eggs in the two years: F. J. Brierley (1), £4; S. Ellis (2), £2 10s.; Mrs. F. L. Snowdon (3), £1 10s.; Bright and Thompson (4), £1.

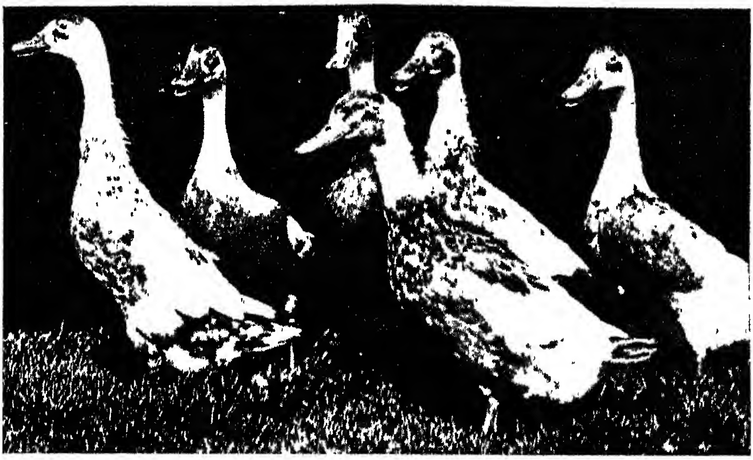


Fig. 28.—Mr. J. Dunlop's Pen, Winner of Gold Medal; First for greatest number of Eggs for Ducks, First Year Contest.

Greatest number of eggs in the second year: F. Herps (1), £5; W. Mitchell (2), £3 A. E. Henry (3), £2; F. J. Brierley (4), £1 10s.; S. Ellis (5), £1; Bright and Thompson (6), 10s.

Fig. 29.—A Duck in Mr. J. Dunlop's Pen.

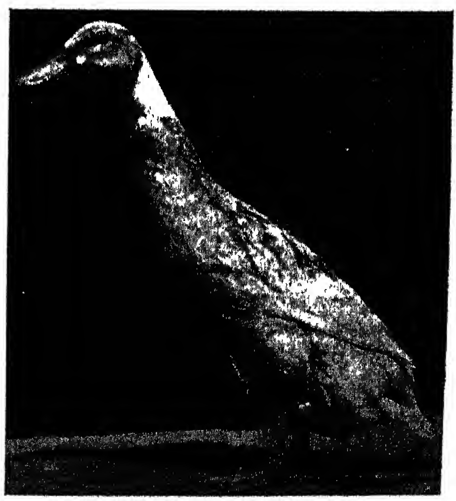


Fig. 30.—Single Duck in Mr. G. Rogers' Pen.

Winter test (April to July inclusive): F. Herps, 368 eggs (1), £2 10s.; Forest Home Poultry Farm, 284 eggs (2), £2; L. A. Herdegen, 269 eggs (3), £1; S. A. Gordon, 246 eggs (4), 10s.

Market value of eggs for two years: F. Herps (1), £2; S. Ellis (2), £1 10s.; F. J. Brierley (3), £1; A. E. Henry (4), 10s.

Monthly prize of £1 for the highest total from a pen in second year: April, F. Herps (106 eggs); May, F. Herps (120); June, L. A. Herdegen (85); July, W. Mitchell (110); August, H. Ellis (126); September, H. Ellis (130); October, H. Ellis (141); November, Mrs. E. L. Snowdon (131); December, H. Ellis (122); January, F. J. Brierley and S. Ellis (129); February, S. Ellis (98); March, J. O. Smith (93).

Champion trophy, value £5, for the pen laying the most eggs in the two years without the replacement of a bird: S. Ellis.

Poultry-breeders' Association's gold medal for member with highest total: F. J. Brierley.

Comparison of Results.

The following compares the results of the three competitions:—

	First.	Second.	Third.
Number of pens	40	50	40
Highest total, two years	2,487	2,624	2,319
Highest total, second year	1,054	1,150	1,013
Average per hen, first year	180	179	190
Average per hen, second year	124	127	140
Profit over feed per hen, first year	11/2	10/11	11/4
,, ,, ,, second year	6/0½	5/4½	9/8
Greatest value eggs, two years	241/6	256/9	262/5

The following compares the average number and value of eggs laid per hen by the different breeds during the first and second year respectively:—

	Eggs per Hen.		Value per Hen.	
	First Year.	Second Year.	First Year.	Second Year.
108 White Leghorns	201·4	139·6	23/7½	16/-
6 Cuckoo Leghorns	193·6	168·0	20/9½	19/10
6 Brown Leghorns	189·3	135·6	21/2	14/10
36 Langshans	184·2	141·5	20/1	17/7
42 Black Orpingtons	192	136·7	20/3½	16/2
36 Silver Wyandottes	174	143·2	18/10½	17/2
6 White Orpingtons	125	107·3	13/	12/10½

The cost of feeding the 240 old hens was:—Bran and pollard, £25 5s.; wheat, £27 10s.; maize, £20 12s. 6d.; meat, £3; green feed, £2; shell grit, £2; sundries, £1; total, £81 7s. 6d.

The total net market value of the eggs laid was £187 0s. 7d., showing a surplus of £105 13s. 1d. over the cost of feed.

EIGHTH ANNUAL TEST.

The outstanding feature in connection with the eighth annual test was the further advance made in the average laying per hen, which was the best of the whole series.

The Prize List.

The prize money for this competition totalled £50, and was won as follows:—

Greatest number of eggs in the twelve months: R. H. Stewart (1), £5; T. Partridge (2), £4; Range Poultry Farm (3), £3; P. Lowe (4), £2; M. A. Vennard (5), £1 10s.; J. Waugh (6), £1; J. Jensen (7), £1; S. O. Jones (8), £1; Tipper and Rose (9), 10s.; Griffiths Bros. (10), 10s.; J. Dunlop (11), 10s.

Winter test (April to July inclusive): R. Maxwell, 472 eggs (1), £4; A. R. Browne, 416 (2), £3; Range Poultry Farm, 413 (3), £2; E. R. Reynolds 408, £1.

Market value of eggs for the twelve months: R. H. Stewart (1), £2 10s.; Range Poultry Farm (2), £1 10s.; T. Partridge (3), £1.

General utility (open to pens, the hens in which average at least 6 lb. in weight on 1st March, 1910, decided by the number of eggs laid): A. R. Kennedy, total weight of hens, 41 lb. (1), £1 10s. ; L. Everingham, 36½ lb. (2), £1 ; E. R. Reynolds, 39 lb. (3), 10s.

Monthly prizes of £1 for the greatest number of eggs from a pen: April, R. Maxwell, 120 eggs ; May, R. Maxwell, 122 ; June, M. Foran, 147 ; July, A. R. Browne, 145 ; August, P. Lowe, 152 ; September, J. Waugh, 144 ; October, J. Waugh, 158 ;

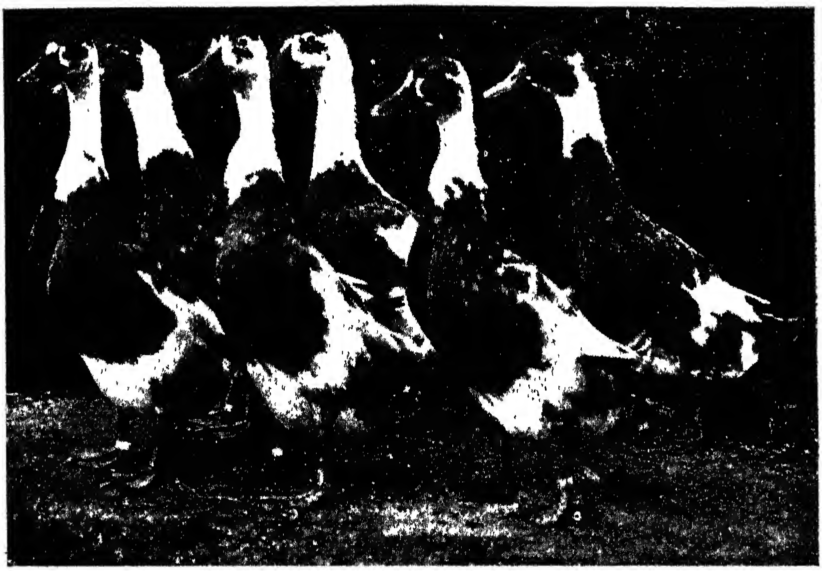


Fig. 31.—Mr. J. Dunlop's Winning Pen of Indian Runner Ducks.

November, P. Lowe, 146 ; December, J. Waugh, D. J. Stephens, and R. Boardman, 134 ; January, R. H. Stewart and P. Lowe, 143 ; February, T. Partridge and J. Dunlop, 105 ; March, P. Lowe, 105.

Poultry-breeders' Association's gold medal for member with highest total : R. H. Stewart.

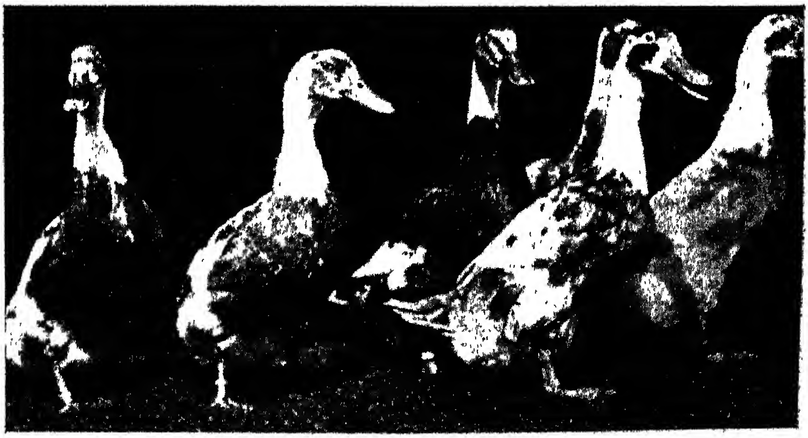


Fig. 32.—Mr. G. Rogers' Pen, Second for Greatest Number of Eggs in First Year Contest.

Results Compared.

The following compares the results of the eight competitions :—

	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.
Number of pens ...	38	70	100	100	100	60	50	60
Winning total ...	1,113	1,308	1,224	1,411	1,481	1,474	1,379	1,394
Lowest total ...	459	666	532	635	721	665	656	739
Highest month ...	137	160	154	168	162	161	159	158
Average per pen ...	130	163	152	166	171	173	180	181
Greatest value ...	140/-	150/-	114/-	125/-	137/-	149/-	146/-	173/-
Average price of eggs	1/1	1/3¾	1/-	11½	1/0½	1/2¼	1/3¼	1/6½
Average per hen ..	15/6	17/9	12/9	13/3	14/10	17/2	19/2	21/9
Feed per hen ..	6/	5/9¾	4/5½	5/3½	5/10	7/-	7/9½	6/9
Profit over feed ...	9/6	12/-	8/3	8/-	9/-	10/2	11/4	15/-

The analysis of the average production of, and the value of the eggs laid per hen by the various breeds, are as follows :—

Breed.	Eggs per hen.	Value per hen.
6 Brown Leghorns	208·1	25/-
204 White Leghorns	192·5	23/4¾
6 Minorcas	192·0	22/5
60 Black Orpingtons	171·8	20/5
6 Golden Wyandottes	169·6	20/7
30 Langshans	158·4	18/8
48 Silver Wyandottes	152·4	19/-

The cost of feeding the 360 pullets was:—Bran and pollard, £37 17s. 6d.; wheat, £42 2s. 6d.; maize, £30 18s. 9d.; meat, £4; green feed, £3; shell grit, £3; sundries, £1; total, £121 18s. 9d.

The total net market value of the eggs laid was £392 4s., leaving a surplus, after deducting the cost of feed, of £270 5s. 3d.

THE DUCK COMPETITION.

An average of 156·5 eggs per duck was obtained in this test. The cost of feeding averaged 9s. 6d. per head, and the average value of the eggs laid was 16s. 6d. per duck, thus giving a surplus of 7s each over the expenditure on feed. The total net market value of the eggs was £123 19s. 7d. The cost of feeding the 150 ducks was :—Bran and pollard, £67 17s.; green feed, £2; shell grit, £1 10s.; total, £71 7s.

The Prize Winners.

The prize money in this test totalled £31, and was won as follows :—

Greatest number of eggs in the twelve months, J. Dunlop (1), £5; G. Rogers (2), £3; Hughes Bros. (3), £2 10s.; D. Salter (4), £2; S. Ellis (5), £1 10s.; G. E. O. Craft (6), £1.

Market value of the eggs in the twelve months: J. Dunlop (1), £2; G. Rogers (2), £1 10s.; Hughes Bros. (3), 10s.

Monthly prize of £1 for the highest total from a pen :—April, J. Dunlop, 107 eggs; May, Hughes Bros., 131; June, G. Rogers, 164; July, G. Rogers, 175; August, W. J. Ransley, 177; September, Johns Bros., 170; October, G. Rogers, 160; November, A. W. Hodson, 141; December, A. W. Hodson, 111; January, J. Benham, 51; February, J. S. Grinton, 87; March, H. Short and G. Plowman, 78.

Poultry-breeders' Association's gold medal for member with highest total: J. Dunlop.

The appended tables give full details of the eggs laid and the net market value from each pen of six birds in the three tests. The figures in parentheses following competitors' names indicate the number of birds replaced during the tests.

The Two Years' Test.

Owner and Breed.	First Year.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Second year.	Grand Total.	Weight per doz.	Market Value.
																oz.	
1. F. J. Brierley (1), Cheltenham : White Leghorns	1330	44	28	20	38	125	119	120	119	114	129	90	43	959	2319	25	257/4
2. S. Ellis (0), Botany : White Leghorns	1333	48	4	27	46	119	107	129	125	108	129	98	34	974	2307	27	260/5
3. Mrs. E. L. Snowdon (1), Guildford : White Leghorns ..	1379	57	0	1	33	107	123	136	131	90	115	55	61	929	2288	24	250/-
4. Bright and Thompson (2), Dulwich Hill : White Leghorns..	1312	24	8	74	76	112	120	137	116	96	70	57	82	971	2234	26	248/1
5. Craig Bros. (0), Black Forest, S.A. : White Leghorns ..	1323	34	1	35	49	110	104	98	117	101	122	86	84	941	2264	26	249/4
6. F. Herps (1), Lower Portland : Black Orpingtons	1248	106	120	78	64	114	110	96	68	78	77	60	42	1013	2261	24	262/5
7. J. Kelly (1), Gore Hill : Black Orpingtons	1288	48	0	44	91	124	108	116	95	90	88	92	62	958	2246	26	247/-
8. A. E. Henry (1), Ryde : Black Orpingtons	1230	63	22	24	69	113	114	126	106	95	109	72	86	994	2224	27	250/6
9. W. Mitchell (1), North Ryde : Cuckoo Leghorns	1162	65	4	47	110	90	124	110	119	102	112	52	73	1008	2170	26	244/1
10. A. H. Padman (2), Adelaide, S.A.: White Leghorns	1203	23	17	42	65	101	125	121	114	108	100	72	59	947	2150	26	235/9
11. Forest Home P. Farm (0), Adamstown : Langshans.. ..	1192	64	51	70	99	120	103	105	94	85	69	44	46	950	2142	25	231/3
12. Mrs. E. Farrar (0), Liverpool : White Leghorns	1268	26	12	55	62	96	111	120	112	103	104	39	33	873	2141	26	235/2
13. Mrs. E. Scaysbrook (0), Gosford : Black Orpingtons.. ..	1221	54	45	46	66	89	88	100	93	93	73	68	73	858	2079	25	227/3
14. R. J. Hapgood (2), Tilba Tilba : White Leghorns .. .	1233	11	0	33	65	102	116	126	94	98	102	60	35	842	2075	30	228/-
15. J. R. Wakfer (1), Chatswood : Langshans	1138	66	68	48	54	108	85	118	76	72	65	77	84	921	2059	26	232/-
16. W. Frame (1), Canterbury : White Leghorns	1225	4	1	56	23	84	111	120	112	111	113	54	22	811	2039	26	224/8
17. W. Whiteoak (1), Rydalmere : Langshans	1126	70	39	41	40	83	104	105	99	94	104	31	77	887	2013	26	226/6
18. Mrs. A. D. Craig (1), Baulkham Hills : White Leghorns .	1193	29	0	6	19	86	116	102	108	95	103	76	59	799	1992	26	220/9
19. L. A. Herdegen (0), Eastern Creek : Silver Wyandottes .	1102	67	70	85	47	95	109	77	92	72	86	57	31	888	1990	25	232/-
20. H. Ellis (1), Harris Park : White Leghorns	1110	4	0	0	44	126	130	141	126	122	111	34	23	861	1971	25	206/6
21. J. A. Alexander (1), St. Peters : Silver Wyandottes	1044	70	56	52	52	101	85	112	84	79	106	71	46	914	1958	25	220/4
22. H. Rudd (0), Narellan : Silver Wyandottes	1036	59	59	46	70	104	109	83	83	84	83	56	80	916	1952	25	217/7
23. A. E. Cooke (1), Colo Vale : Brown Leghorns.. .. .	1137	10	0	3	11	106	115	122	126	98	98	63	60	814	1951	25	216/-
24. J. O. Smith (0), St. Peters : White Leghorns	1080	29	0	0	4	103	111	118	109	110	93	78	93	853	1933	26	205/7
25. S. Wade, jun. (1), Tamworth : Silver Wyandottes .. .	1105	72	58	29	27	84	93	90	88	81	80	57	61	820	1925	26	217/9
26. C. L. Simon (1), Moruya : White Leghorns	1052	15	0	20	42	120	112	128	107	101	106	63	29	843	1895	27	208/-
27. E. J. Winton (1), Nowra : Langshans	1128	38	67	63	65	88	97	64	69	54	53	35	62	755	1883	26	213/4
28. W. H. Forsyth (0), Willoughby: White Leghorns .. .	1106	24	18	23	35	91	116	126	127	102	88	25	0	775	1881	27	191/1
29. S. A. Gordon (2), St. Ives : Langshans	1090	61	53	54	78	109	74	69	71	60	51	50	59	789	1879	26	211/6
30. A. O. Weynton (1), Willoughby : White Leghorns .. .	1130	7	0	41	77	108	100	97	95	62	88	39	13	727	1857	30	202/-
31. R. E. Warren (2), Glenfield : Silver Wyandottes .. .	997	34	45	62	64	92	109	85	82	62	83	61	78	857	1854	26	214/4
32. R. J. Stuart (1), Blacktown : White Leghorns	1026	30	0	41	34	104	107	118	123	81	95	50	38	821	1847	25	163/9
33. J. C. Harris (0), Tamworth: White Leghorns	1198	36	4	1	41	78	86	88	78	96	74	48	28	648	1846	27	199/-
34. B. Poole (0), Leichhardt : Langshans	959	35	5	62	71	114	113	78	72	76	83	40	38	792	1751	26	196/9
35. R. C. Fletcher (1), Granville : Silver Wyandottes .. .	979	27	41	62	80	107	85	58	75	64	63	58	41	761	1740	24	199/-
36. J. Stewart (1), Berowra : White Leghorns	1257	5	11	33	20	71	65	61	46	60	56	35	18	481	1738	27	221/2
37. S. Gordon (3), St. Ives : Black Orpingtons	1084	0	2	13	48	82	78	104	76	60	83	39	46	631	1715	25	187/1
38. L. H. Coates (2), Lewisham : Black Orpingtons .. .	1084	24	8	20	67	77	78	39	65	58	70	49	26	581	1665	27	182/-
39. L. L. Ramsay (0), Carlingford : Black Orpingtons .. .	909	51	19	56	47	88	95	85	98	55	57	34	25	710	1619	28	178/3
40. Mrs. H. Small (0), Chatswood : White Orpingtons .. .	750	37	15	62	8	85	70	84	70	71	68	48	26	644	1394	25	155/3

Eighth Annual Test.

The appended Table gives full details of the eggs laid, and net market value of the eggs from each pen of six hens in the eighth competition, the replacements of the birds being indicated by the figures in parentheses after competitors' names.

Owner and Breed.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Total.	Weight per doz.	Market Value.
														oz.	
1. R. H. Stewart (0), Berowra : White Leghorns	87	32	127	140	141	142	143	131	112	143	104	92	1394	25	173/8
2. T. Partridge (0), Marrickville : White Leghorns	22	93	105	124	137	138	148	137	127	132	105	100	1368	27	165/7
3. P. F. Range (0), Toowoomba (Q.) : White Leghorns	58	90	136	129	131	133	134	133	115	123	93	66	1341	25	166/-
4. P. Lowe (1), Lower Portland : White Leghorns	0	29	118	138	152	139	155	146	118	143	81	105	1324	26	158/7
5. M. A. Vennard (0), Marsfield : White Leghorns	102	42	56	111	135	125	148	142	128	131	101	85	1306	24½	160/1
6. J. Waugh (0), Kurri Kurri : White Leghorns	55	35	77	130	141	144	158	144	134	136	61	81	1296	24	153/9
7. J. Jensen (1), Sefton Park : White Leghorns	96	75	108	121	131	121	125	114	103	111	89	83	1276	25	158/5
8. S. C. Jones (1) Wentworthville : White Leghorns	48	54	119	125	137	128	142	138	127	115	74	63	1270	25	152/5
9. Tipper and Rose (0), Belmore : White Leghorns	49	69	108	104	131	150	146	130	128	128	76	67	1266	26	153/8
10. Griffiths Bros. (0), Balgowlah : White Leghorns	33	47	135	104	138	130	127	132	121	135	71	90	1263	24½	153/8
11. J. Dunlop (0), Marrickville : Brown Leghorns	15	49	97	84	134	134	149	139	112	141	105	90	1249	24	149/9
12. A. R. Browne (0), Hawkes Bay (N.Z.) : White Leghorns	63	101	107	145	137	121	133	133	91	125	62	27	1245	24	154/9
13. G. Wright (0), St. Peters : White Leghorns	45	60	113	80	120	123	145	131	113	125	104	79	1238	27	149/9
14. R. Maxwell (0), Moruya : Silver Wyandottes	120	122	94	136	138	114	91	108	69	100	71	73	1236	25½	159/2
15. J. O. Smith (1), St. Peters : White Leghorns	5	50	109	128	142	141	134	122	112	126	82	74	1225	27	148/7
16. A. R. Kennedy (0), Guildford : Black Orpington	45	46	125	135	135	135	137	118	87	100	68	86	1217	26½	145/3
17. Wharepaka Yards (1), Berowra : White Leghorns	54	25	95	141	138	133	147	129	115	128	70	36	1214	24	145/2
18. D. J. Stephens (0), Rouse Hill : White Leghorns	48	46	86	107	126	125	142	142	134	130	90	35	1211	27	147/-
19. A. F. Emmott (0), Moruya : White Leghorns	9	73	113	132	124	127	134	136	111	131	45	64	1199	24½	145/3
20. O. J. Mitchell (0), Lower Portland : White Leghorns	16	53	114	111	135	143	148	131	102	110	68	64	1195	25½	143/4
21. A. J. Wood (0), Quirindi : White Leghorns	39	81	104	105	107	114	125	120	116	114	80	74	1179	24½	143/3
22. W. T. Ely (0), Rydalmere : Minorcas	34	50	65	75	115	134	138	130	106	136	96	73	1152	23	134/7
23. G. Du Faur (0), Turramurra : White Leghorns	18	51	123	126	135	129	126	84	72	113	97	60	1134	26	142/6
24. L. Everingham (0), Central Colo : Black Orpingtons	32	78	73	130	118	122	135	113	100	86	69	75	1131	24	133/5
25. M. Foran (0), Concord : Black Orpingtons	6	29	147	123	140	115	94	102	90	110	93	81	1130	24	140/9
26. Farradene Yards (0), Liverpool : White Leghorns	30	7	102	11	116	127	135	112	113	112	74	74	1113	26	123/9
27. R. Boardman (0), Camden : White Leghorns	64	14	61	88	133	137	148	140	134	123	37	11	1090	28	126/7
28. Cowan Bros. (0), Burwood : White Leghorns	21	65	106	79	128	129	132	128	101	76	82	41	1088	26½	127/-
29. A. W. Hodson (0), Enfield : White Leghorns	0	28	108	111	119	117	128	127	97	104	71	68	1078	25¼	137/4
30. E. R. Reynolds (1), Paterson : Black Orpingtons	64	85	125	134	129	98	105	97	82	72	55	19	1068	24	131/8
31. J. C. Gould (1), Wallsend : White Leghorns	29	67	94	90	129	121	119	118	111	102	46	38	1064	25½	127/9
32. W. K. Graham (1), Moruya : White Leghorns	51	70	95	68	106	115	137	109	110	108	47	45	1064	25	129/-
33. A. F. Caller (0) Ryde : Black Orpingtons	56	63	104	71	123	96	116	107	76	93	79	80	1064	25	130/7
34. Mrs. W. F. Hunt (0), Berowra : White Leghorns	72	40	99	84	126	131	134	122	90	74	48	32	1052	24½	133/-
35. L. S. Luck (1), Moruya : White Leghorns	46	75	85	67	98	130	131	125	104	102	46	29	1038	24½	124/9
36. L. K. Pettit (0), Albury : White Leghorns	45	34	73	85	99	124	148	133	87	103	50	56	1037	26½	121/7
37. W. C. Cox (0), Canterbury : White Leghorns	11	47	76	79	107	124	142	127	105	120	61	25	1024	25	122/1
38. Mrs. M'Kittrick (0) South Grafton : Golden Wyandottes	4	69	91	111	117	116	108	99	78	83	70	72	1018	22	123/7
39. Fuller Brothers (1), Kiama : White Leghorns	37	31	66	68	112	127	134	110	110	107	64	37	1003	27½	118/2
40. R. H. Erwin (0), Rooty Hill : White Leghorns	41	57	107	61	111	111	116	117	91	97	60	28	997	25	121/9
41. Mrs. F. S. Howell (0), Maitland : Langshans	28	45	97	74	126	108	109	112	82	111	67	36	995	25	120/9
42. R. H. Blamey (0), Kogarah : Black Orpingtons	0	14	69	100	124	134	123	111	87	97	69	60	988	26	113/9
43. W. White (1), Stanmore : Langshans	9	52	75	93	128	112	135	84	106	84	58	46	982	26	114/7
44. W. Mann (0), Glenreagh : Black Orpingtons	57	34	54	75	133	105	109	111	102	86	63	50	979	27	112/8
45. Miss Harvey (0), Rydalmere : Langshans	14	70	61	104	93	95	88	123	86	105	65	75	979	25½	119/4
46. T. Cook (0), Plumpton : Silver Wyandottes	89	39	72	96	104	100	101	84	62	80	73	71	971	26	119/-
47. E. Hough (0), Auburn : Silver Wyandottes	43	78	108	92	130	116	106	88	69	51	35	38	954	23½	113/-

Eighth Annual Test—*continued.*

Owner and Breed.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Total.	Weight per doz.	Market Value.
														oz.	
48. A. J. Laraghy (1), Singleton: White Leghorns	36	17	31	64	113	130	117	116	116	108	41	46	935	27½	107/-
49. Mrs. M. L. Reynolds (1), Richmond: Black Orpingtons	27	1	75	90	128	117	107	99	67	98	55	70	934	26	109/3
50. D. B. Banister (0), Pymble: Black Orpingtons	20	42	109	48	118	132	107	95	73	65	68	46	923	25½	107/6
51. C. Poole (0), Leichhardt: Langshans	38	42	73	87	109	104	92	100	77	88	63	45	918	26	110/7
52. E. Debus (1), Enfield: Silver Wyandottes	104	83	111	86	102	101	83	55	53	46	43	43	910	25	114/9
53. A. W. Duke (0), Nyngan: White Leghorns	14	21	80	98	112	113	111	119	69	107	30	33	907	24	107/-
54. G. Hopping (2), Ingleburn: Silver Wyandottes	36	56	54	79	92	92	101	90	82	87	64	62	895	24	110/-
55. H. Fleming (0), Willoughby: Langshans	0	1	69	93	138	95	102	99	80	94	70	57	878	27	102/3
56. E. Waldron (0), Willoughby: Black Orpingtons	6	33	86	72	109	113	95	93	74	86	48	62	877	26½	103/4
57. T. Lawrence (0), Cowra: White Leghorns	47	23	64	81	70	101	110	111	80	84	57	30	858	27½	102/3
58. H. Rudd (1), Narellan: Silver Wyandottes	32	73	95	96	84	93	89	83	64	64	61	29	863	25	107/8
59. T. Brophey (0), Upper Manilla: Silver Wyandottes	19	33	69	80	114	121	97	81	57	81	52	44	848	23	99/7
60. G. Howell (0), Wentworthville: Silver Wyandottes	20	37	64	56	104	69	74	68	83	78	43	43	739	24	89/6

The Duck Competition.

Full details of the laying of each pen of six ducks are given in the appended table, the replacements of birds being indicated by the figures in parentheses after competitors' names:—

Owner and Breed.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	Feb.	March.	Total.	Weight per doz.	Market Value.
														oz.	
1. J. Dunlop (1), Marrickville: Indian Runners	107	118	138	114	146	135	137	130	68	49	60	33	1235	30	134/5
2. G. Rogers (1), North Ryde: Indian Runners	0	26	161	175	168	165	160	123	78	41	77	43	1220	31	126/9
3. Hughes Bros (0), Teralba: Buff Orpingtons	14	131	150	133	139	100	140	75	49	23	35	56	1105	32	119/-
4. D. Salter (1), Wilberforce: Indian Runners	56	119	146	103	149	145	112	97	51	32	44	38	1092	32½	118/-
5. S. Ellis (0), Botany: Indian Runners	42	90	115	90	150	155	148	101	70	31	39	23	1054	31½	108/9
6. G. E. O. Craft (0), Ingleburn: Indian Runners	20	47	124	132	140	138	148	87	41	48	54	55	1034	31	109/9
7. W. J. Ransley (0), Llandilo: Indian Runners	30	20	163	169	177	161	149	62	25	6	39	23	1024	32	111/1
8. F. Clifford (0), Putney: Indian Runners	19	74	116	128	131	157	128	76	74	38	42	38	1021	33	110/9
9. Johns Bros. (1), Wyong: Indian Runners	26	43	115	113	140	170	146	84	45	13	55	61	1011	29	102/4
10. G. Plowman (0), North Bondi: Indian Runners	38	23	136	145	148	132	128	88	45	17	13	78	991	30	103/1
11. D. Fraser (1), Miranda: Indian Runners	44	109	144	137	136	105	100	56	30	43	33	37	974	31½	107/9
12. H. Short (0), Ryde: Indian Runners	27	38	92	111	139	119	117	97	82	41	31	78	972	25½	101/9
13. Scott Bros. (0), Moree: Indian Runners	46	38	154	126	114	116	119	83	26	14	67	30	935	30	101/9
14. A. W. Hodson (0), Enfield: Indian Runners	0	6	91	112	101	118	143	141	111	37	13	28	901	33½	99/1
15. W. T. Ely (0), Rydalmere: Indian Runners	6	26	24	106	147	164	152	133	71	31	17	23	900	31½	88/-
16. H. J. Hollier (0), Emu Plains: Indian Runners	30	33	39	60	93	150	159	115	97	20	49	52	897	30	86/5
17. J. Benham (1), Botany: Indian Runners	11	29	138	135	103	137	108	76	72	51	2	10	887	30	93/5
18. E. R. Lennane (0), Eastern Creek: Indian Runners	22	49	106	119	138	136	105	86	51	9	21	43	885	30	99/1
19. Griffiths Bros. (1), Balgowlah: Indian Runners	10	96	137	106	70	89	103	85	86	16	38	37	873	34	101/1
20. J. S. Grinton (0), Albury: Indian Runners	4	0	99	87	151	154	114	89	40	5	87	30	860	33	85/1
21. W. Broughton (1), Glenfield: Indian Runners	26	39	106	65	127	151	119	87	79	10	19	32	860	33½	84/9
22. J. M'Intyre (1), Waverley: Indian Runners	21	56	76	75	160	114	91	95	57	21	0	41	815	34	81/-
23. G. Howell (1), Wentworthville: Indian Runners	27	56	111	98	92	96	95	89	34	19	65	18	800	33½	85/1
24. H. Ahern (1), Arncliffe: Buff Orpingtons	14	0	5	54	126	144	158	106	58	0	27	47	739	31	65/1
25. A. R. Kennedy (2), Guildford: Indian Runners	64	90	58	1	29	77	73	59	24	5	10	17	507	32	54/4

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th (imp.).	Wollongbar Farm	†
„ ...	March Pansy ...	Earl March ...	Australian Pansy.	Grafton Farm ...	*
„ ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II. ...	Thessalian (imp.).	Egyptian Princess (imp.).	Wagga Exp. Farm	*
„ ...	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm ...	*
„ ...	Golden Lord ...	Golden King (imp.).	Colleen (imp.)	Wagga Exp. Farm	*
Guernsey ...	Gentle Prince ...	Rose Prince (imp.).	Gentle ...	Rous Mill... ...	5 Sept., '10.
„ ...	The King's Mirror.	Calm Prince ...	Vivid (imp.)...	Cumbalum ...	10 Oct., '10.
„ ...	Prince Edward..	Rose Prince (imp.).	Vivid (imp.)...	Grafton Farm ...	*
„ ..	Star Prince ...	Calm Prince ...	Vivid (imp.)...	Dunoon	3 Sept., '10.
„ ...	Prince Souvia ...	Vivid's Prince...	Souvenir (imp.)	South Woodburn..	21 Sept., '10.
„ ...	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Wollongbar Farm	*
„ ...	Claudius ...	Golden Star II..	Claudia's Pride (imp.).	H.A. College, Richmond	*
„ ...	King of the Roses	Hayes' King ...	Rose 8th (imp.)	Berry Farm ...	*
„ ...	Parson's Hope	Clatford Hope 2nd	Parson's Red Rose 2nd (imp.).	Wollongbar Farm.	*
„ ...	Royal Preel ...	Otchen Royal ...	Hayes' Lily du Preel (imp.).	„ „	*
Red Poll ...	The Judge ...	Barrister (imp.)	Lovely 8th (imp.).	Grafton Farm ...	*
Ayrshire ..	Don Juan ...	General (imp.)...	Judy 9th (imp.)	Bathurst Farm ...	*
„ ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
„ ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower.	Berry Farm ...	*
„ ..	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
„ ..	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
„ ...	Dan of the Roses	Daniel of Auchenbrain (imp.).	Ripple Rose...	H.A. College, Richmond	*
Kerry... ...	Kildare II ...	Kildare (imp.)...	Belvedere Bratha 3rd (imp.).	„ „	*
„	Bratha's Boy ...	Aicme Chin (imp.).	Bratha 4th	„ „	*
„	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Holstein ...	Hollander ...	Bosch III. (imp.)	Margaretha (imp.).	Berry Farm ...	*

* Available for service only at the Farm where stationed † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 2nd July, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

HOLSTEINS.—Maastricht: sire, Obbe II; dam, Lady Margaret; calved 26th June, 1908; price, £15.

Count Wittereen: sire, Obbe II; dam, Lolkje Zuyder Zee; calved 27th November, 1908; price, £15.

HAWKESBURY AGRICULTURAL COLLEGE.

AYRSHIRES.—Dado: sire, Daniel of Auchenbrain (imp.); dam, Dot, by Hover of Southwick (imp.), from Flirt, by Heir of Randwick (imp.), from Lady of Randwick; calved 23rd March, 1904; colour, white and brown; price, £20.

Emerald's Mischief: sire, Prince Emerald (imp.); dam, Miss Prim, by Mischiefmaker of Barcheskie (imp.), from Primrose of Barcheskie (imp.), by Royal Stuart of Glenbuck, from Lindsay 7th of Barcheskie; calved 4th August, 1903; colour, white and red; price, £30.

WOLLONGBAR EXPERIMENT FARM.

GUERNSEY.—Admiral du Preel: sire, The Admiral; dam, Hayes' Lily du Preel IV (imp.), 6903, from Hayes' Lily du Preel III, 6166, by Hayes' Royal, 1674; calved 4th April, 1909; colour, lemon and white; price, £45.

HOLSTEIN.—De Wet: No. 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909; price, £10.

The prices indicated are at the places named, or on rail.

H. C. L. ANDERSON,
Under Secretary.

Orchard Notes.

W. J. ALLEN.

July.

Pruning.

The majority of our growers of deciduous fruits are, or should be, busily engaged pruning their trees this month. There is usually an abundance of fruiting wood in our best plums, peaches, nectarines, and apricots, after once they have commenced to bear, and therefore the pruning is mostly a question of thinning and shortening the past season's growth.

Many varieties of apples and pears, when once they are well formed, may continue putting forth wood growth, but carry very little fruit-bearing wood if they are cut heavily each winter. In such cases it is well to thin them slightly, but not cut them back much for a season. By following this method they should (if old enough) be made to develop a good lot of fruiting buds and spurs during the summer. It may even be two summers before some will develop such buds and spurs, but when once the tree is well furnished with fruiting wood it may be pruned as desired.

Each variety has its own individuality, and the grower should study the habits of each, and then prune them in such a way as will ensure the best results from year to year.

All refills should be planted without further delay.

When new orchards are to be planted, the sooner they are in now the better, as the roots start growing this month, and the better hold they get in the ground in the early part of the season the stronger growth they will make during the summer. While pruning or working around the trees, always keep a sharp lookout for any diseases which are likely to attack them, and mark any tree so affected. Burn all prunings as soon as possible. The most expeditious way to accomplish this is to mount on wheels an old tank, with grating in bottom, into which the prunings are thrown and burnt while being drawn by a horse from tree to tree.

All wood cuttings for grafting should be laid in the ground.

Apply stable manures. In cold late districts plant late varieties of apples and pears for exporting.

Scrape and burn loose bark from apple, pear, and quince trees.

Orchards should be kept in thorough order from 1st July to 1st April each year.

San Jose Scale.

The following wash has been found one of the best, viz. :—15 lb. of best lime and an equal weight of sulphur to 50 gallons of water. The sulphur, after being mixed with enough water to form a thin paste, is put into 12 gallons of water nearly at the boiling point; the lime is then added, and the mixture boiled for forty minutes with the necessary stirring. The whole is strained into a 50-gallon tank, which is then filled with water. It is important that the operator should bear in mind that solutions made by stirring the sulphur into the hot water first, and adding the lime to this mixture, are more efficient than if the order of procedure is reversed.

Export of Apples.

In our shipment of apples to the Old Country, the Cleopatras stood first and the Rome Beauties second, with Jonathans third. The Munroe's Favorite was very well spoken of, but the Granny Smiths were a little on the green side; Margils sold well, and it is pleasing to note that the Pommes de Neige landed in good condition; but the Esopus Spitzenbergs were disappointing, and though a very nicely-coloured apple and of exceptionally good flavour, they brought only low prices.

Our crop of fruit at Bathurst was the heaviest we have yet had, yielding 5,650 cases. As the returns are not all in yet, it is too early to say what the year's results will be.

Bandages for Codlin Moth.

These may now be removed from all apple, pear, and quince trees, and all grubs found thereunder destroyed. Such bandages may then be boiled, and if in good condition put away for future use. In no case should bandages be allowed to remain on trees all winter, nor should they be removed without destroying all grubs thereunder at time of removal.

I have to acknowledge receipt of some particularly fine specimens of Rome Beauty from Mr. E. K. Wolstenholme of Bathurst, which ran about thirty-two to the bushel case; and from Mr. Thomas Howson, of Penrose, some splendid specimens of well-coloured Yates apples. It is only in a few districts that this latter variety does well.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Lachlan P. and A. Association (Hillston)	S. G. Gordon ...	July 21
Deniliquin P. and A. Society	L. Harrison ...	,, 21, 22
Hay P. and A. Association	G. S. Camden ...	,, 26, 27
Riverina P. and A. Society (Jerilderie)	W. Elliott ...	,, 26, 27
Balranald P. and A. Society	A. Malcolm ...	,, 27
Condobolin P. and A. Association	T. Tasker	Aug. 2, 3
Narrandera P. and A. Association	W. T. Lynch ...	,, 3, 4
Corowa P., A., and H. Society...	J. D. Fraser ...	,, 16, 17
Coolamon A. and P. Association	J. W. Skien ...	,, 17
Forbes P., A., and H. Association	H. J. Brooke ...	,, 17, 18
Gunnedah P., A., and H. Association...	M. C. Tweedie ...	,, 23, 24, 25
Murrumbidgee P. and A. Association	A. F. D. White ...	,, 23, 24, 25
Parkes P., A., and H. Association	G. W. Seaborn ...	,, 24, 25
Grenfell P., A., H., and I. Association	Geo. Cousins ...	,, 30, 31
Wyalong District P., A., H., and I. Association ...	T. A. Smith ...	,, 30, 31
Junee P., A., and I. Association	T. C. Humphrys...	,, 31, Sept. 1
Young P. and A. Association	G. S. Whiteman...	Sept. 6, 7, 8
Ariah Park P., A., H., and I. Association	A. T. White ...	,, 7
Germanton P., A., and H. Society	J. S. Stewart ...	,, 7, 8
Albury and Border P., A., and H. Society	W. I. Johnson ..	,, 13, 14, 15
Ganmain A. and P. Association	J. H. Ashwood ...	,, 14
Northern A. Association (Singleton)	H. A. Bennett ...	,, 14, 15, 16
Cootamundra A., P., H., and I. Association... ...	T. Williams ...	,, 15, 16
Temora P., A., H., and I. Association	John Clark ...	,, 20, 21, 22
Millthorpe A. and P. Association	R. H. French ...	,, 27, 28
Crookwell A., P., and H. Society (Spring Show) ...	M. P. Levy ..	Oct. 7
Mullumbimby A. Society	N. Neilsen ...	Nov. 9, 10
Lismore A. and I. Society	T. M. Hewitt ...	,, 16, 17, 18

1911.

Society.	Secretary.	Date.
Kiama A. Association	R. Somerville ...	Jan. 25, 26
Alstonville A. Society	W. W. Monaghan	Feb. 8, 9
Berry A. Association	C. W. Osborne ...	,, 8, 9
Shoalhaven A. and H. Association (Nowra) ...	H. Rauch ...	,, 15, 16
Kangaroo Valley A. and H. Association	J. Moffit	,, 23, 24
Inverell P. and A. Association	J. McIlveen ...	,, 28, Mar. 1, 2, 3
Gundagai P. and A. Society	A. Elworthy ..	Mar. 7, 8
Tenterfield P., A., and M. Society	F. W. Hoskin ...	,, 7-11
Tumbarumba and Upper Murray P. and A. Society...	E. W. Figures ...	,, 8, 9
Crookwell A., P., and H. Society (Annual Show) ...	M. P. Levy ...	,, 9, 10
Central New England P. and A. Association (Glen Innes)	G. A. Priest ..	,, 14, 15, 16
Bellinger River A. Association (Bellingen)	S. S. Hindmarsh	,, 15, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 16, 17, 18
Luddenham A. and H. Society...	W. Booth ...	,, 21, 22
Armidale and New England P., A., and H. Association	A. McArthur ..	,, 21-24
Yass P. and A. Association	W. Thomson ...	,, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 5, 6
Dungog A. and H. Association	C. E. Grant ...	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 5, 6, 7
Queanbeyan P., A., H., and I. Association	E. C. Hincksman	,, 12, 13
Bathurst A., H., and P. Association	A. H. Newsham...	,, 26, 27, 28

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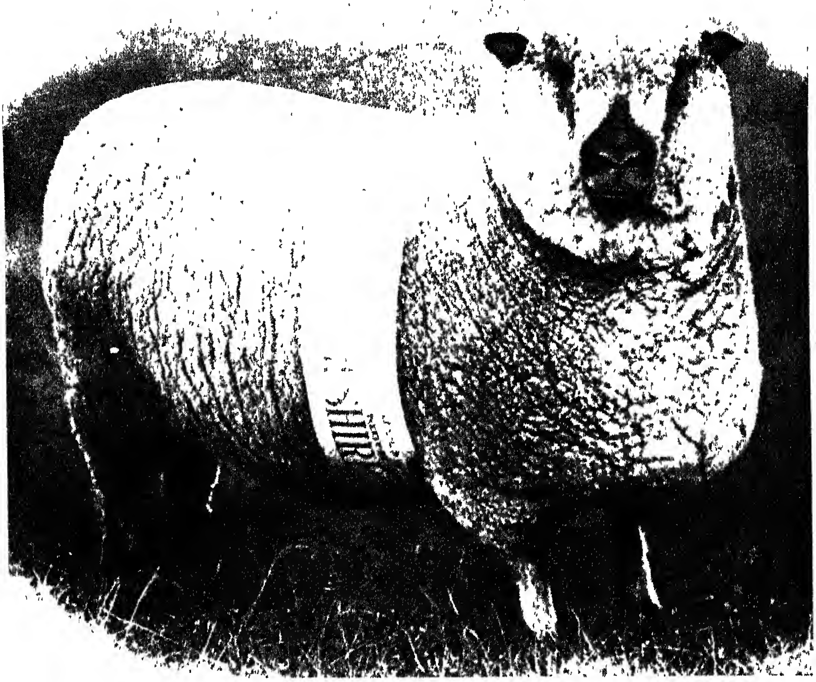
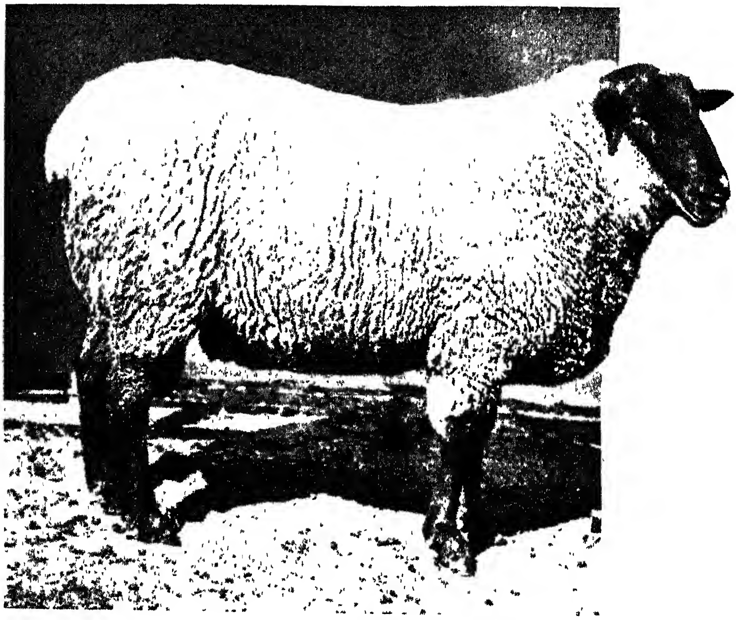


Shropshire Ram.

Shropshire Ewes.



Suffolk Ram.

Suffolk Ewes.

VOL. XXI. PART 8 AUGUST 2, 1910.

Agricultural Gazette of New South Wales.

Sheep and Wool for the Farmers.

J. WRENFORD MATHEWS.

THE CLASSIFICATION OF BREEDS.

The Principles of Breeding.

WITH regard to a question of breeding, a matter of the first importance is origin. The naturalist, equally with the scientific stock-raiser, is trying to trace the origin, to get back to the source, to understand the principles underlying development.

No two sheep are ever exactly alike. Yet we can classify large groups according to type, that is, group them according to a certain normal or average character. Change of character or departure from type is known to the scientist as "variation." The term is correctly used for any such change, however slight. Generally, however, it means difference to such an extent as to produce quite distinct changes. Thus in the case of sheep there may be noted marked variation in frame, fleece, and constitution.

The passing on of characteristics from one generation to the next and the following generations is known as "transmission." Thus, as a result of transmission the progeny comes to resemble the parent, or as it is popularly phrased, "like father like son." Formerly it was supposed that only the characteristics of the sire were transmitted, but experimenters soon found that the dam also largely influenced the character of the progeny.

Thus the ancestral germinal substance that goes to make up the comparatively tiny male or female cell can contain the individual character or variations of the parent, and further, in some strange way, transmit all of these to the offspring. It is the adding together of such variations by natural or artificial selection that has produced different species, breeds, or types.

Darwin's work on origin and type stands out as the most important and far-reaching on this subject. His "Origin of Species" formed a rich legacy to the investigators who followed him. To those who could appreciate and apply his theories, new and vast fields were opened up, in pioneering new lands with breeds and species known only to the old world. Of the evolution theory as put forth by Darwin there is, perhaps, no better example than the history of the merino and the manner of its development in Australia and elsewhere. It is only a little over a century since the first flock was introduced, yet so rapidly have they reproduced and become modified by climate and environments that many sub-varieties of the breed have been evolved. This is also true, though in a lesser degree, of the British breeds.

A

Our object in the present article is to glance at the origin of those distinct varieties, tracing their evolution and investigating their usefulness under Australian conditions.

Regarding the first domestication of sheep, nothing is known beyond the fact that wild varieties were found in several regions of the globe. So frail are the connecting links between the domesticated breeds and their primitive representatives that little information is available of the steps of their domestication. Even Darwin admitted himself that he was unable to make any definite statement as to the origin of sheep and goats. Other authorities are likewise divided as to the number of original varieties. The number has been placed even as high as eleven distinct wild species. The rather more than thirty British breeds converge by such insensible gradations that the problem is a difficult and complex one. Indeed, were it not for the external differences, such as shape, size, colour, covering and formation of head, it would be difficult to distinguish many related types. Yet by careful analytical study of the characteristics, structural features, development of body, and character of wool, both in length and quality of fleece, we are strongly inclined to refer them all to one or other of two main types.

Thus, before attempting a more or less detailed account of different breeds, it is necessary to refer briefly to those great groups, and to outline their prominent characteristics.

One group is distinguished by a long, raking, comparatively gaunt frame, and possesses a greater weight of fleece in proportion to that of body when compared with the breeds of the other group. The legs and face are white, and the skin of a rich pink. More important, however, is the character of the fleece. It is long-stapled, coarse, and lustrous—in some cases over a foot in length—varying in length and character according to the nature of the breed. This is the Long-wool group of breeds.

The other group is much more symmetrical in body, being short and compact, more perfectly developed, and more evenly proportioned. The sheep are finer boned, and carry a greater proportion of flesh. As contrasted with the white-complexioned Long-wools, they are conspicuously black of feature, legs, and head. The skin is much darker and purplish in colour. The wool is short, and deficient in valuable characteristics, being harsh in texture. There is an absence of yolk or natural grease; consequently the fleece is light and brittle, and is distinguished by a peculiar grey hue. This is the Short-wool or Down group of breeds.

The underlying difference between these great groups is in the proportionate weight of frame, flesh, and wool to the total body weight in each case. A breeder must, therefore, first decide on what basis he is going to work, whether for wool or mutton. Then he must remember that it is this proportion between frame, flesh, and wool respectively, and total body weight, that determines type. Thus either weight of fleece or weight of carcase and early maturity may be aimed at, but not both in the same breed. A sheep that will produce a large quantity of wool cannot at the same time yield the maximum quantity of flesh; nor could the economical mutton breed,

with its earlier maturity, be maintained as a profitable wool type. It was by the application of this principle of compensation that Bakewell was able to evolve the famous Leicester breed. Many of the most successful Australian Merino breeders likewise owe their success to due regard for this same principle.

LONG-WOOL BREEDS.

The Long-wool group comprises the following breeds :—

Lincoln,	Border Leicester,
Cotswold,	Romney Marsh,
Leicester,	Cheviot.

These breeds are named in their order of decreasing fleece production and increasing early maturity. These qualities vary somewhat, but it is only where uniformity of type has not been maintained that the above order changes to any great degree.

With regard to the Cheviot, it might be well to state that it forms a type intermediate in many particulars between Long-wools and Short-wools. Personally, I regard it as more nearly allied to the former. In the matter of fleece production, it certainly resembles the Short-wools. But its pink skin, purity of colour in the fleece, white face and legs, and general conformation of body, together with the readiness with which it may be crossed with members of the Long-wool group, clearly indicate its relationship to that group.

We may now briefly outline the more prominent characteristics of each of these Long-wool families.

Lincoln.

The Lincoln has existed in the fens of Lincolnshire beyond all record. It is regarded as the foundation of all the British Long-wool breeds and the source from which they have all evolved. Careful study of its characteristics and conformation amply prove this. As compared with the other Long-wool families, it has a less attractive body, being somewhat long and gaunt. The bone is coarse and prominent, the neck inclined to be long, and the head is large and heavy. It is a true wool type. Together with the Merino, it responds most readily of all breeds to breeding for wool. Its fleece attains the greatest length, and its fibres are of the coarsest quality. As might be expected in the case of such a bountiful wool producer, it is not an early maturer; but in compensation for any deficiency in this respect, it retains its vigour to a greater age. The Lincoln is thus more profitable during the later periods of its life. At an age when other breeds would show signs of decline, the Lincoln is still in its prime. Though somewhat delicate while young, the Lincoln's later maturity tends to preserve its constitution. This naturally results in later life in considerable increase in weight.

Cotswold.

This historic breed, although well-known in the Old Country, has not been largely used in Australia. From time to time it has been greatly modified by

crossing with other strains. This has resulted, as always, in considerable variation of type. The general description of frame and quality of fleece to be observed in such Cotswold types as may be studied in Australia, lead us to place it next to the Lincoln. In spite of all such variations, the Cotswold remains a distinct and reliable type. It is a long-necked, big-framed sheep, and very hardy in constitution. Its fleece lacks many of the more distinctive characteristics of the Lincoln. It is scarcely as coarse, and is straighter and more open in staple, thus producing a lighter fleece. This lightness of fleece is associated as usual with somewhat earlier maturity.

Leicester.

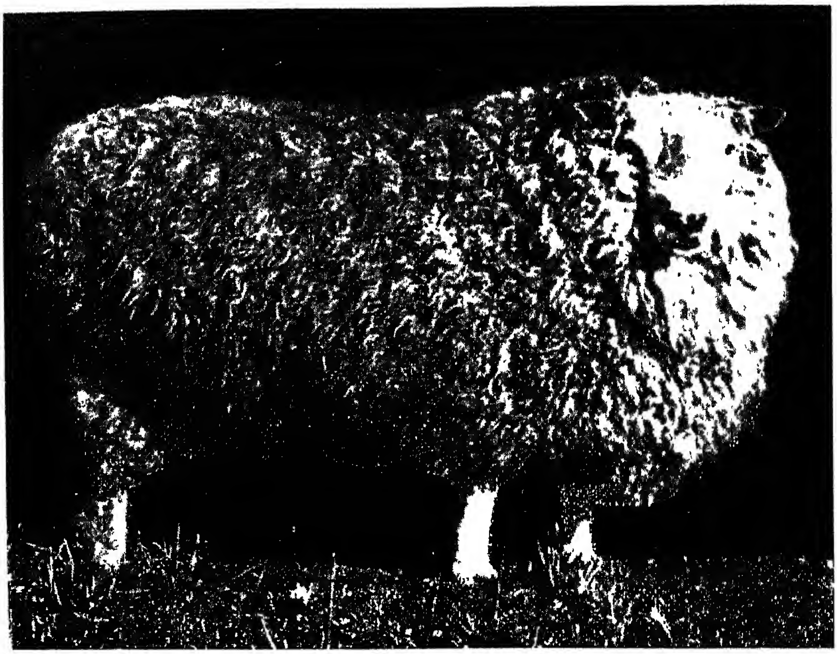
No breed has been the subject of more comment, or attracted more attention than the Leicester. The first step in the development of the long-wool sheep in the direction of early maturity and improved mutton production was made with this breed. With it there is always associated the name of Bakewell of Dishley. Bakewell early recognised how profitable an improved mutton breed would become. He worked on sound scientific lines, and seems to have thoroughly understood the principles of sheep-breeding. The object lesson furnished by the development of the Leicester is sufficient, apart from the present value of that breed, to make it of the utmost importance. Formerly there existed in Great Britain two types of Leicester—the older and the more modern or Dishley breed. This latter was evolved from the older type, which was itself regarded as an offshoot from the Lincoln. Since its appearance the Leicester has exerted a good influence on the most of the long-wool flocks of Great Britain. Some have been greatly improved by Leicester blood, others owe their existence to it. The Leicester, as improved by Bakewell, exhibits, as compared with the Lincoln, a finer bone structure. Bakewell aimed at a sheep that would produce the maximum proportion of saleable meat for a given body weight. He regarded wool as of little importance, except in so far as heavier fleeces meant a proportionate decrease in the production of mutton. As compared with the Lincoln, the fleece of the Leicester, in consequence of the finer nature of that breed, is shorter in staple and of finer texture. Bakewell discovered at an early stage that to attain his ideal type of sheep he must sacrifice fleece production to increased weight of flesh.

Border Leicester.

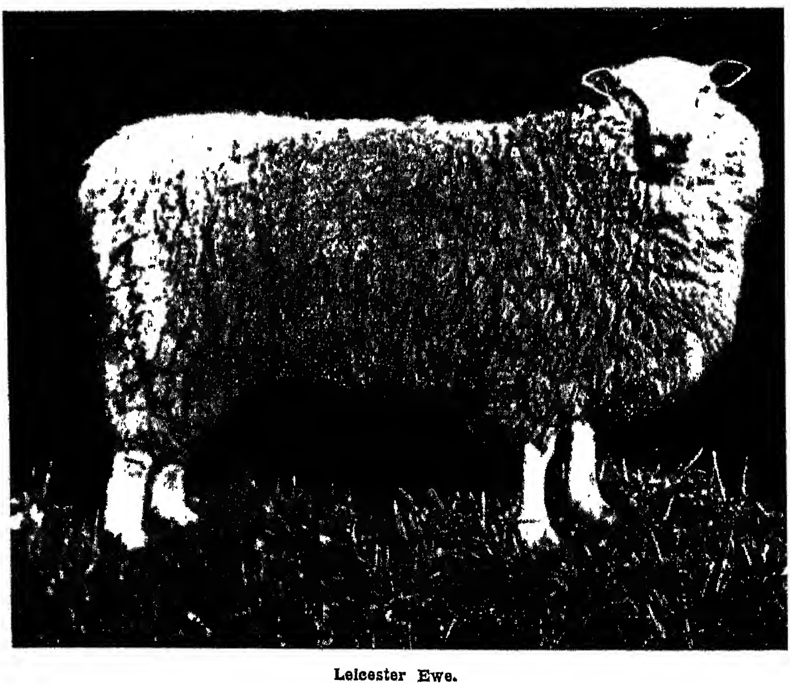
The Border Leicester affords a good illustration of man's ingenuity in evolving special types of animals to suit special needs. By the selection and mating of suitable breeds, the desirable qualities of two different classes of sheep have been combined in one strain. The Leicester, famous for its flesh, was nevertheless regarded as somewhat delicate in constitution. On the border of England and Scotland there flourished a sheep rather similar to the Leicester, and noted for its hardiness. This was the Cheviot. By crossing the Leicester and the Cheviot a new type was produced, combining the quality of flesh, for which the Leicester was so well known, with the greater hardiness of the Cheviot. This new breed was called the Border Leicester.

Lincoln Ram.

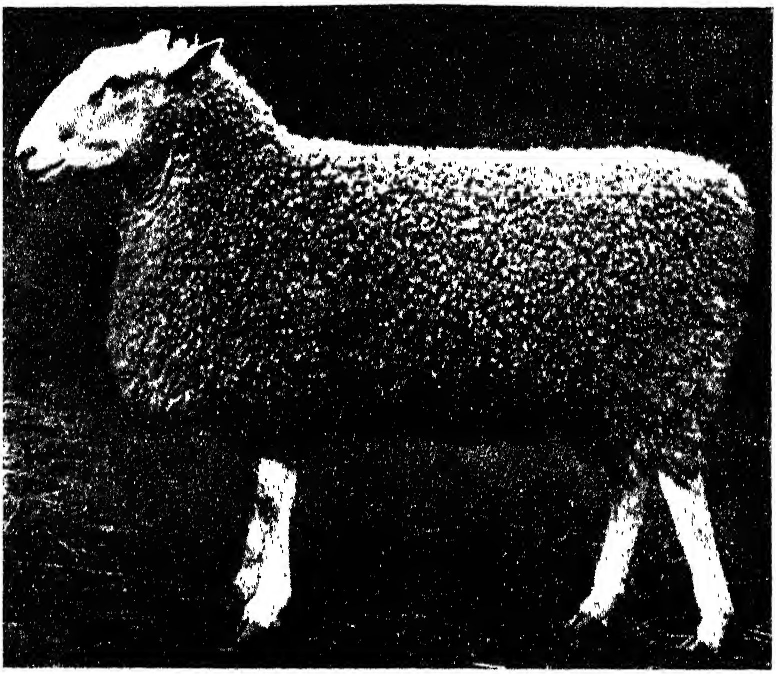
Lincoln Ewes.



Leicester Ram.



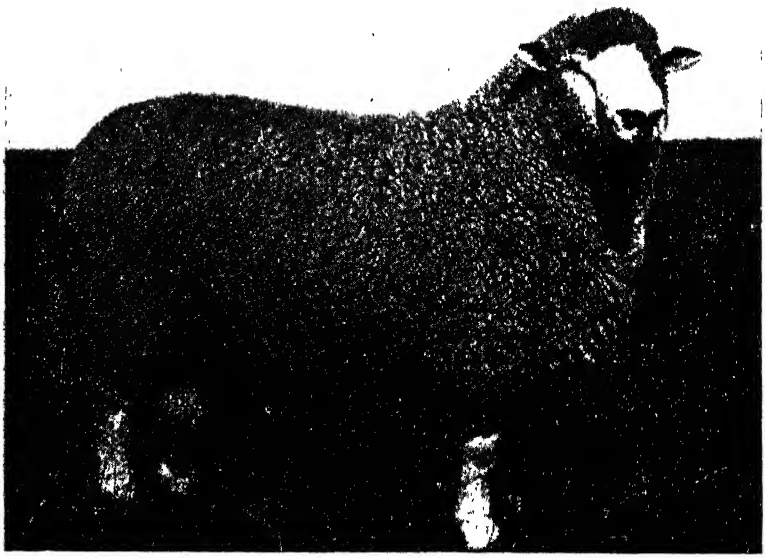
Leicester Ewe.



Border Leicester Ram.

In body development it resembles the Leicester, being square, well proportioned, and symmetrical. In some respects, for example in bone formation, it is more like the Cheviot. It is quite the equal of the Leicester in early maturity. Its wool varies somewhat. If the true type is maintained, it should be rather finer than the Leicester, but coarser than the Cheviot. Its hardiness and somewhat early maturity, together with its fairly profitable fleece, make it a good dual-purpose sheep.

Border Leicester Ewes.



Romney Marsh Ram.

Romney Marsh.

Amongst the historical breeds none are more highly thought of, or fill a more important place, than the Romney Marsh. These sheep, and indeed all British breeds, have been evolved under certain special conditions, a fact which must be kept in mind in view of the great importance of maintaining the standards of type which English flock-masters have set. Although

Romney Marsh Ewes.

included amongst the Long-wools, it cannot be regarded as an ideal wool producer. Its strongest point is its magnificent constitution, and in the consequent freedom from disease which this secures for it. The Leicester is characterised by a fine bone structure and aptitude to fatten on rich pastures. The Lincoln, on the other hand, characterised by a heavy fleece, is so constituted as to produce this greater amount of wool. Intermediate between these two types in characteristics is the Romney Marsh. Whilst the energy of the Leicester tends to make it fatten readily, and that of the Lincoln goes in fleece production, the vital force of the Romney is applied in so fortifying its constitution as to enable it to withstand the diseases to which its swampy surroundings render it liable. The success of sheep-raising in swampy districts depends very largely on the use of this sheep, which must, however, be maintained true to the original type. Although one or two efforts have been made to introduce Leicester blood into the Romney, the idea was given up because of a distinct tendency to render the naturally hardy constitution of the Romney more delicate and more liable to disease. The Romney is big-framed and coarse-boned, features which at once denote hardiness of constitution to any man of experience.

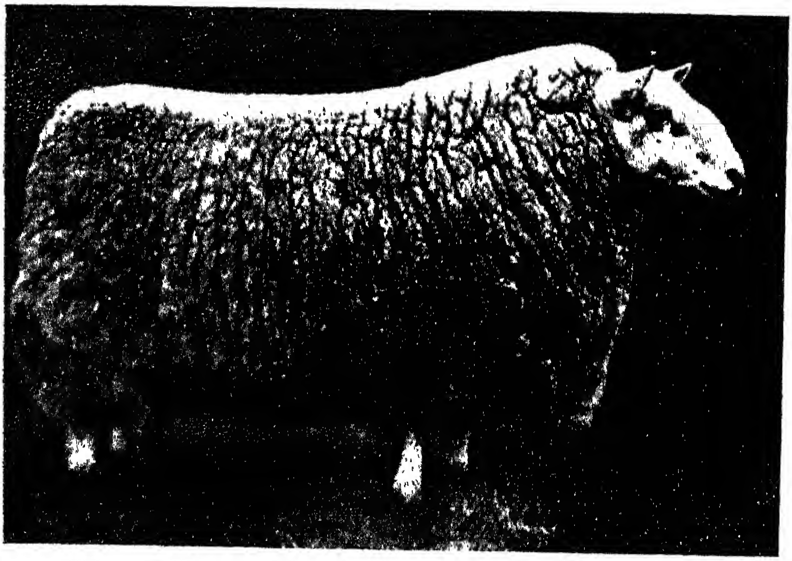
The true Romney wool is somewhat finer of fibre than the Border Leicester, but harsher in texture and deficient in some of the distinctive characteristics of wool breeds.

Of all breeds of this group it should produce the lightest weight fleece in proportion to body weight, with the exception, perhaps, of the Cheviot. Experiments on wool-growing made with this breed have demonstrated that increase in weight of fleece can only be secured at the cost of weakening the constitution. Although its early maturing qualities are well known, it is not quite the equal of the Leicester or Border Leicester in this respect. Still, its hardy constitution compensates for this.

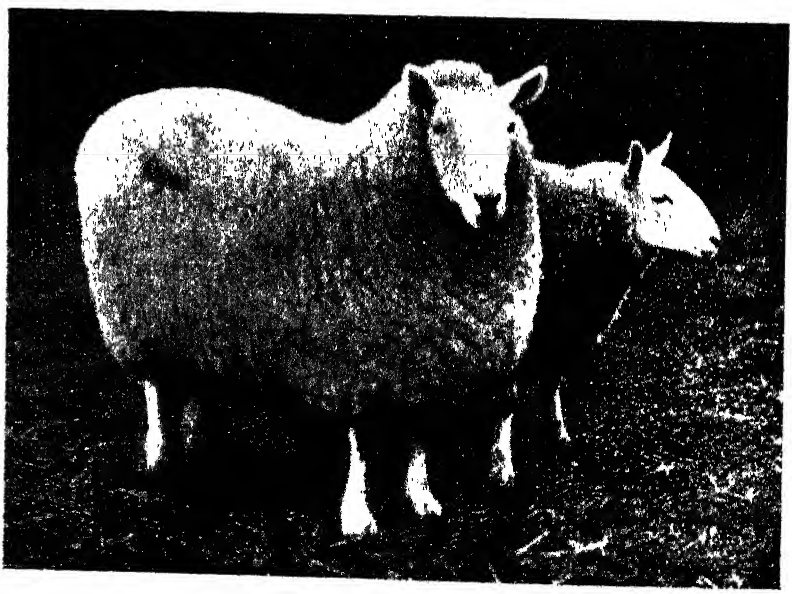
Cheviot.

The hardiness of the Romney Marsh enables it to be successfully kept in swampy districts. Another sheep is equally fitted by its constitution to thrive on the sparser herbages and in the more rigorous climate of the English-Scottish border and the uplands of Northumberland. This is the Cheviot. It is one of the older breeds, and its exact history is difficult to trace. Some authorities incline to the belief that it includes Lincoln blood. It is a deep bodied, fine boned, well proportioned sheep. The fleece is of the finer quality, a characteristic already noted as belonging more to the Long-wool races. This breed is scarcely known in Australia, and for our purposes its place could generally be advantageously filled by almost any of the foregoing breeds. As met with in Australia it is the wildest and least domesticated of all sheep. Its importance in Great Britain is due to the fact that it mates well with the Leicester. Indeed the Border Leicester has to some extent displaced it, even in its original home. In view of its hardiness and ability to thrive on rougher pastures and in colder climates, the Cheviot may yet be found suitable for use in some of the mountainous parts of this country.

There are a few other Long-wool types, but they are practically unknown in Australia. They are mere offshoots of one or other of the breeds already mentioned.



Cheviot Ram.



Cheviot Ewes.

SHORT-WOOL BREEDS.

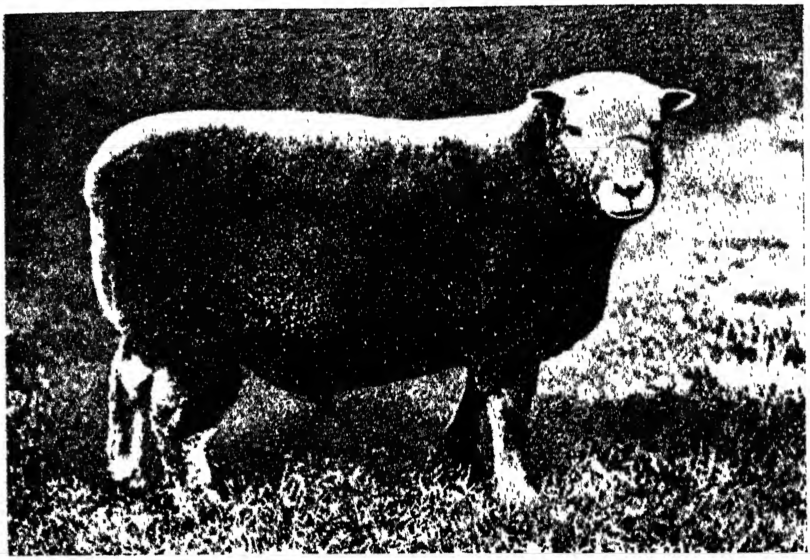
The average man is inclined to suppose that the difference between Long-wool and Short-wool sheep consists entirely in the fact that while the former has long wool, the wool of the latter is short. This difference in length of wool, it need hardly be said, is, however, merely the outward sign of great and far-reaching differences in practically every detail. The sheep is something more than an animal that produces wool; its flesh also is in great demand. A sheep that at the same time produced a heavy fleece of valuable wool, yielded a large carcase of prime mutton, and matured at an unusually early age, would be an exceedingly profitable type. This sheep, however, has not yet been discovered, and probably never will. Unfortunately, or perhaps fortunately, excellence in one direction is always linked with comparative limitation in the other. "In order to spend on one side, nature is forced to economise on the other side." The contrast between the carcase of a fat steer and that of a dairy cow is strikingly in favour of the former—just as much as the dairy cow's milk exceeds that of a cow of the beef breed. Thus such a small detail as a few inches difference in the length of a sheep's wool tells a vast amount. It indicates a certain more or less definite size, form, and symmetry of frame; certain distinct characteristics of the skin and its glands; a certain tone in the whole constitution of the animal; a certain degree of prolificness; and even certain fairly minute particulars as to the disposition of the sheep that produced it, the extent of which it was domesticated, and the kind of pasture on which it was reared. All these details, and many more besides, enter into the division of sheep into Long-wools and Short-wools. Thus these names, so far from merely stating the length of wool, are to be used as convenient terms for denoting two groups of sheep of quite opposite type.

The Short-wools comprise:—

South Down,
Shropshire,
Hampshire,
Oxford Down,
Suffolk.

South Down.

While it is not by any means easy to discover exactly how these different Short-wool varieties originated, yet there may readily be discerned in all the rest the distinctive characteristics of the South Down. This appears to indicate their common origin from the South Down. The earlier history even of the South Down itself is rather uncertain; yet it undoubtedly forms a pure uniform and valuable type. Even where the South Down appears to exhibit some slight variation, it nevertheless maintains in all cases that compactness of frame and uniform body development of the typical Short-woolled sheep. Just as the Lincoln stands at the head of the wool breeds, so the South Down occupies a similar position with respect to the improved mutton breeds. The South Down therefore presents a type quite the opposite of the Lincoln. While the latter is long and gaunt in body and carries a fleece of the long-wool stapled order, the South Down, as already noted, possesses a beautifully-proportioned frame, compact and covered with short, fine wool. Owing to the



Southdown Ram.

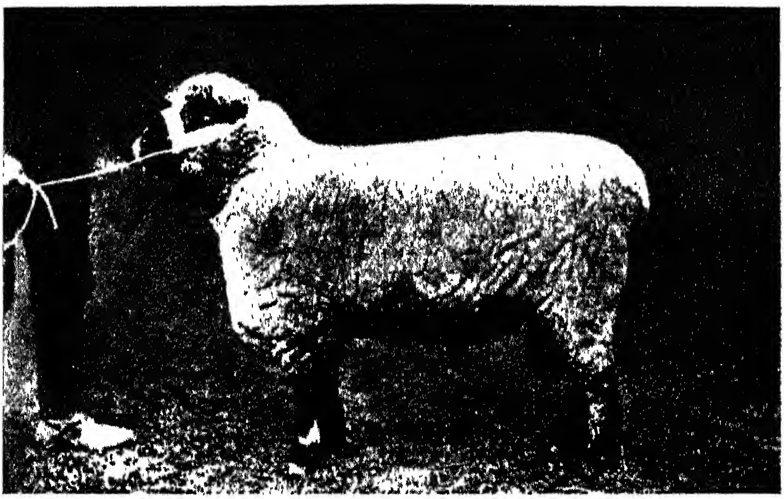
harsher texture of its fibre, the South Down, in proportion to the length of its wool, produces a very light fleece. The great value of the South Down lies in the excellence of its mutton. Although well known as an early maturer, yet most of the bigger and grosser breeds described among the Short-wools are its superiors in this respect.

Shropshire.

The Shropshire is a more modern development, and does not thrive quite as true to type as the South Down. From time to time considerable variations may be noted in this breed. It has been described as an offshoot from a somewhat diminutive breed—the Morfe-Common sheep, with which the South Down was formerly mated. Amongst the early-maturing Down varieties it has become one of the most popular breeds. The Shropshire is rather larger in frame than the South Down, to which breed, as has already been indicated, it owes its origin. It is noted for its excellent mutton and early maturity. It is an exceedingly hardy sheep, even more so than its progenitor, the South Down. Its somewhat longer and deeper body is covered with wool of a short, harsh texture, and slightly coarser-fibred than that of the South Down. The face and legs carry more wool than in the case of any other Down breed. Many Australian breeders have shown marked preference for the Shropshire, and from time to time it has been made the subject of experiments in wool-growing. The Shropshire, however, is essentially a mutton breed, and the only result of these misdirected attempts have been to somewhat impair its usefulness in this respect.

Hampshire.

This is a comparatively recent addition to the British breeds, and its introduction into Australia has been correspondingly delayed. In many respects it closely resembles the Shropshire, and though its exact origin is a little doubtful, it is thought that the earlier types contain both Shropshire and South Down blood; for, like all Short-wools, it possesses many of the characteristics of the South Down. It is, however, considerably coarser in bone than the original breed. The fleece is variable, but in respect to average quality ranks with the Shropshire. It carries, however, less wool on the head and points than the Shropshire. It is very prolific, and famous for its early maturing quality, being regarded by many breeders as superior to the Shropshire in this respect. Its progress is especially rapid at about twelve months.



Oxford Down Ram.

Oxford Down.

Much the same might be said of the Oxford Down. It is another comparatively recent development of the Down family. It is said to be an offshoot from the Hampshire as a result of mating that sheep with one of the Long-wools. The coarser type of wool produced supports this view. The Oxford Down resembles the Hampshire and Shropshire, and more the former than the latter, especially in the coarseness of its bone. Although well thought of in Great Britain, little or nothing is known of this breed in Australia.

Suffolk.

The Suffolk is generally regarded as having been derived from an old aboriginal English breed, the Norfolk, by mating with the South Down.

The Norfolk, now practically extinct, was badly shaped, but possessed a splendid constitution. Its union with the South Down produced one of the most valuable mutton breeds the Old Country at present possesses. The Norfolk's long legs and neck have been retained in the Suffolk, while its body has been greatly improved by South Down blood. Just as in the case of the Long-wools, the Border Leicester was obtained by combining the Leicester and Cheviot, so, amongst Short-wools the Suffolk owes its origin equally to the Norfolk and the South Down. Those are striking illustrations of the manner in which two distinct breeds may, by scientific breeding, be used to evolve a new and highly profitable type. The Suffolk is noted for its fecundity and extreme early maturity. Its young stock can be marketed considerably earlier than that of other breeds. These qualities have been attained at the expense of the wool, and no breed yields in proportion to body weight a lighter fleece, or produces wool of poorer quality.

The foregoing Short-wool families comprise the British mutton breeds in more general use in Australia. The breeds of this group are characterised by black faces and legs.

Dorset Horn.

There is, however, another breed which, although maturing earlier, does not exhibit these typical black points. This is the Dorset Horn. Furthermore, the black-pointed breeds are all polled, while the Dorset, as its name implies, possesses horns. Of none of these breeds is the earlier history altogether definite or satisfactory, but this is especially true of the Dorset Horn. Its many peculiarities increase the difficulty of tracing its origin. Concerning its characteristics, the Dorset Horn seems a "chaos of contradictions." Its prolificness and extreme early maturity associate it with the Down types. The purity of colour of its fleece, and the whiteness of its face and legs, connect it somewhat with the Long-wools. The singular development of its horns lends itself to speculation as to the possibilities of connection at some remote period with the Merino. This suggestion is, of course, merely speculative, but still it is supported in some measure by the fact that there is some record of Merino sheep having been cast away as far back as the sixteenth century by the wreck of some of the galleons of the Armada. It is interesting to note in this connection the most remarkable fact of the Dorset's great suitability for mating with the Merino. Experiments so far with this breed have gone far to prove its value in this direction, and to show that it must become increasingly important from year to year. The Dorset Horn has retained its characteristics to a remarkable degree. It is distinguished from the other Down varieties in many particulars. Its body is somewhat peculiarly shaped. The neck is longer and inclined to be slender, and the breed is somewhat coarser in bone. Its wool is of the poorest description, even as compared with other Down types, being destitute of character, short, and harsh in texture, characteristics always associated with a most unprofitable fleece.

A GLANCE AT THE TRUE PRINCIPLE.

Associated with extreme early maturity, and correspondingly lighter production of wool, is the fact that if a sheep develops rapidly, its decline, when once it has past the height of its powers, is just as rapid. In discussing the Lincoln it was noted that while that breed matured slowly and the fleece developed gradually and did not reach its maximum weight till comparatively late, yet that sheep preserved its vigour and remained profitable at a very much later period of its life than in the case of an extreme early maturer like the Dorset Horn.

In thus contrasting these two extreme types, the Lincoln and the Dorset Horn, we arrive at a more definite conclusion as to the totally distinct phsyical character of the two great groups. On the one hand are the Long-wools, arranged in order of fleece production and early maturity; on the other are the Short-wools, classified according to larger body development and still increasing early maturity.

The foregoing system of classification places more definitely before us the nature and characteristics of the different British breeds, though their discussion is at this stage necessarily incomplete. The information available as to the origin of each, limited as it often is, is invaluable in view of its important bearing on the development of our great sheep industry. Each breed, evolved in a certain locality and under definite conditions, should be employed, as far as possible, in similar localities and under similar conditions.

It would, for example, be unwise to place the Romney Marsh, with its lighter fleece, on "richer pastures," for the Lincoln, a true wool type, would yield a much greater profit on such country. On the contrary, the Romney, with its more vigorous constitution, would thrive where the Lincoln would fail. The "pampered" Leicester has, for a similar reason, often had to give way to its hardier relative, the Border Leceister.

If the above classification be correct, to use an early maturing Down breed in the endeavour to raise a profitable fleece, would be quite absurd. Yet such errors are not unknown in Australia. Growers have been working on the strangest systems, or on no system at all. It is quite common to find Down types being used on the Merino for the production of wool. Just as the Lincoln has been used for the raising of early lambs for market, so the Romney has often been placed in districts more suitable either to the Lincoln or Leicester. Furthermore, purity of type must be maintained, in order to preserve the desirable characteristics of each breed. It is waste of energy and opportunity, and in fact mere folly, to impair purity of a type to get it to do indifferently what another type could have done very much better.

THE MERINO.

We have devoted the bulk of this article to a discussion of the respective merits of such of the numerous British breeds as are kept in Australia. Yet we must not overlook the fact that whatever the future may bring forth, our wool markets are of promising importance. Our export of mutton is large

and increasingly important, yet somewhat uncertain. The Australian climate is very variable. Agricultural development has not yet sufficiently assisted this branch of the sheep industry. We are on the other side of the world from the greatest mutton-consuming centres, and must compete with countries much more favourably situated. On the contrary, our wool markets are at our doors and firmly established. Whilst every effort must be made to cater for both branches, and so reap a double profit from the sheep industry, yet our greatest and most stable market is undoubtedly that for wool.

Whilst the British breeds have engaged most of our attention in this paper, we cannot, in view of the demands of our wool markets, overlook the fact that their usefulness must, to a very considerable extent, be determined by their suitability, under Australian conditions, for mating with the Merino. The Merino has become a distinct national type, and from a national standpoint all other breeds, Long-wool and Short-wool alike, are subordinate to it. So important is it that, although it might reasonably be classed as a Short-wool, we have come to regard the various Merino strains as constituting a distinct third group.

Thus the evolution of wool-types is not a mere case of mating a British Long-wool with the Merino, so much as a matter of deciding what variety of the Merino group shall be employed.

In the *Agricultural Gazette* for May, 1910, several distinct types of Merinos found in this and other States have been referred to in connection with the important subject of climate and its influence on type. In order to get a more definite understanding of these varieties, and to be in a position to fully consider their ultimate usefulness from our present standpoint, that of the farmer, a further classification is necessary. On what basis, then, are these many distinct types to be so grouped that their relative value may be readily apparent? We are not aiming at a purely scientific classification. Our aim, as repeatedly stated, is distinctly practical. The great point is to discover the most profitable type of sheep. Yet, if such classification is to have any real value, we must look for the physical laws of type and variation. The British breeds have been arranged according to weight of fleece in proportion to the total body weight. But this is not a case of choosing, haphazard, one characteristic and neglecting the rest. It may be artificial to classify sheep according to wool production; but even so, the fact remains that it is a classification on a natural basis, that it is logical in view of the commercial importance of the wool, and that it has been found to hold good in practice.

As compared with the British breeds, the Merino is much more distinct and uniform in type and body. This makes the task of classification less easy. There are important variations; but it takes a fairly keen observer to appreciate them. The characteristic wool of the Merino, like that of the British breeds, is subject to slight but definite variation both in quantity and quality, and those differences may be made the basis of a somewhat general yet thoroughly reasonable and practical classification. That the character of the wool is associated with the type of Merino that produced it,

and the climate in which it was grown, is well illustrated by the accompanying table. Exceptions to such rules may always be found—exceptions which, nevertheless, only serve to "prove" them. For instance, while the Merino of the southern tableland of New South Wales is indicated as small framed, with a short, fine fleece, bigger framed, more robust sheep are to be found there in considerable numbers. It will be found, however, that in practically all these cases these larger animals have not been locally bred. They have been introduced from other districts for the purpose of keeping up the size of the local flocks, and have, moreover, come from those same drier and hotter areas of which they form the typical sheep.

The same comparison may be made with regard to fine-woolled sheep entering the drier areas from colder districts. Although finer in quality and smaller in frame, if allowed to remain sufficiently long in their new home, time will work a wonderful change in type. They will increase correspondingly in size, and their wool, while it will scarcely become as coarse as in the case of the locally-bred sheep, will yet be much coarser than in their own district.

CLASSIFICATION OF THE MERINO.

The Sheep.			The Locality.	
Wool.		Frame.	Climate.	Typical Areas of New South Wales.
Quantity.	Quality.			
Long.	Coarse.	Big.	Hot and dry.	Riverina—The Lachlan.
Medium.	Medium.	Medium.	Temperate.	Western Slopes.
Short.	Fine.	Small.	Cold.	Southern Tableland. New England. Mudgee.

Thus from the farmer's point of view these Merino types may, broadly speaking, be divided into—

(1.) Coarse-woolled Merinos.
(2.) Medium-woolled Merinos.
(3.) Fine-woolled Merinos.

The main differences between these groups are in size of frame, length and quality of fleece, and early maturity, variations which are most characteristic. Thus the big-framed, coarse, deeper-woolled Merino of drier districts will mature earlier than the small-framed, finer, and denser-woolled sheep of the colder districts. These are facts which the farmer cannot afford to disregard in making his choice of a Merino strain to mate with a British Long-wool for the production of wool and mutton.

Romney Marsh Ewes.

Lucerne in Riverina District.

The best time to commence cutting lucerne is when a fair proportion of the crop is in flower, as its nutrient value is then at its best, and the least loss in weight will ensue if the hay is properly saved.

The length of time allowed for drying in the field will, of course, depend on weather conditions.

When high temperatures prevail in dry districts, when the crop is cut with the mower it should be at once raked into windrows, and in about twenty-four hours drawn into cocks by means of the horse-rake. In some cases, however, it will be ready to stack in that time. It is undesirable to allow it to lie behind the machines just as cut, as the drying process is so rapid as to cause loss of foliage in subsequent handling.

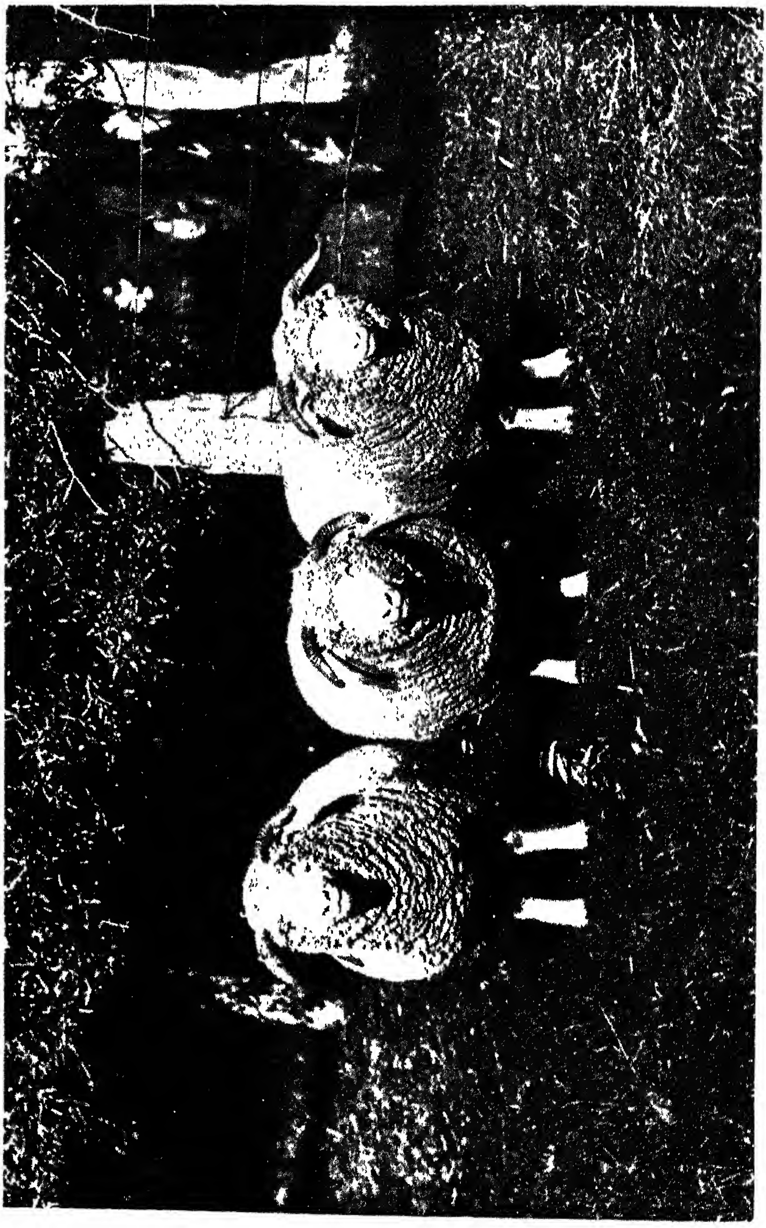
The aim of the maker should be to get the hay into stacks with as little handling, consistent with proper curing, as possible.

In hot, dry weather, in districts where summer dews are infrequent, the reaper and binder cannot be surpassed as an implement for cutting, as it is more economical in labour and the hay may be saved with the minimum amount of handling.

Lucerne will dry thoroughly in sheaves in such weather, but care should be taken not to stook heavily, the best method being to stand the sheaves in rows, not more than two deep. By this means practically no loss of foliage need occur, if no loss of time occurs in stacking. The colour of hay so cured will be all that can be desired, and it will retain its full nutrient value, as loss by bleaching is prevented.

G. M. McKeown.

Dorset Horn Ram.



Dorset Horn Ewes.

Red Clover.

H. C. L. ANDERSON.

To one who has seen, with pleasure, the fields of red clover grown for pasture and for hay in Italy, Switzerland, France, Germany, all parts of Great Britain, and in most of the States of America, it is a matter for surprise to find what a small part clover plays in our system of farm management. We are familiar with white clover in our best pastures along the coast districts from the Tweed River to Bega, but it generally lasts for only a few weeks in the Spring of the year. Every dairy farmer knows how much his milk yield is improved while the clover is thick amongst the paspalum or rye grass or cocksfoot or native grasses. We have learnt to value any leguminous plant, native or exotic, which comes in our pastures, even though some of them, like the yellow trefoil, may give a taint to the milk, when too luxuriant in the early Spring; and we know that no pasture is complete which does not contain a vetch or clover or pea or trefoil among its grasses and other herbage. Some of us have learnt to sow some legume with each of our fodder crops, cowpeas with maize, vetches with barley, peas with oats, and lucerne or red clover with wheat, and we find the resultant fodder—a cereal mixed with a leguminous crop—to be a perfect food for our dairy cattle, our horses, sheep, and pigs; but the perennial variety of clover (*Trifolium pratense perenne*), sometimes, unfortunately, called cow grass, has not yet found its true place in New South Wales agriculture. Many who have tried it in districts with uncertain rainfall and a hot summer, have been disappointed to find it fading away very quickly after the first summer heat of November; others who have tried it in districts where the soil is deficient in potash or lime, have been disappointed with its poor growth; but there are a number of districts in this State where it will pay handsomely, not only as a fodder mixed with the grasses suited to the district, but as a main crop for hay, to be cut when in full flush, and afterwards grazed with immense advantage both to the stock and to the soil.

In the New England district particularly this has been proved, and the same will probably be found true in many parts of the southern tableland, from Bathurst to Bombala, and in the temperate parts of the South Coast from Nowra to Eden.

The Bathurst and Glen Innes Experiment Farms have been the pioneers in this matter, and have clearly proved that red clover is a profitable crop for fodder for sheep and cattle, also for hay, and for improving the mechanical condition of the soil, increasing its stores of nitrogen, and making a sod which is the best possible seed-bed for a potato crop to follow.

Mr. E. McCausland has followed, with great advantage, the lead set by the Glen Innes farm. In May last year he sowed 17 acres of wheat for

hay, and, after harrowing the grain, he sowed about 6 lb. of clover seed to the acre. After a crop of 2 tons of wheaten hay had been removed at Christmas, the clover came on very strongly, and was soon fit for cutting. He then took a crop of 2 tons per acre of clover hay from this paddock, and has had 70 to 80 cows grazing upon it every day, for a period varying from half an hour to an hour, during the past six months. The beneficial results have been very evident in the milk supply, which has kept steady through a dry spell of two months, a most unusual thing for this highly-favoured district, and the return for milk has been maintained at £1 per cow per month. He has been so well satisfied that he is sowing 6 lb. of seed per acre with every one of his wheat crops this year, and is confident that the expense of the seed will be returned to him manifold: first in improving the feeding quality of the wheaten hay by the presence of a considerable quantity of clover; second, in supplying a further cutting of clover hay a month later; and, third, in providing rich nitrogenous food to supplement the scanty pasture and silage fed during the winter months. Hitherto lucerne has been deemed the one and only leguminous crop which would pay for cultivation as a perennial pasture; but deservedly popular as lucerne is, it will be found that, for New England and districts with similar conditions of climate and soil, red clover is safer and more profitable, and is destined to prove a valuable factor in the agricultural development of the State.

A number of farmers in the district, including the manager of the Furracabad Estate, are following this lead, and have every confidence that they will get equally good results.

Farmers in districts which enjoy a fair rainfall, a summer heat not excessive, and strong loamy soils well supplied with lime and potash, are strongly advised to try the same experiments, and to sow a few pounds of red clover seed with all their cereal crops. It will grow strongly when the first rain falls after the removal of the cereal crop, and will soon provide a welcome addition to the usual summer and autumn pasture, whether for cows, sheep, or pigs. Although the humble bees, introduced from New Zealand on several occasions, have apparently not established themselves in New England, the clover is fertilised by some insect, probably the native bee, and seed is produced in fair abundance, as is proved by the dense growth of young plants near the stack of clover hay, and by the perceptible thickening of the sole of clover plants in the pastures, which have been laid down several years. Note specially that this fine seed must be sown on the surface, and not harrowed or rolled in, except on light soils. We especially urge that the best seed be procured, and nothing but the true Perennial Red Clover used.

The Department proposes to import some approved strains from the Old Country and from America, to ascertain whether any of them are better than those which have been acclimatised in New Zealand, from which is imported the bulk of the seed now procurable at reasonable prices from our leading seedsmen.

Notes on the Soil occurring in the Area served by the Barren Jack Irrigation Scheme.

F. B. GUTHRIE.

THE soils over the area which it is proposed to irrigate by means of canals from the Barren Jack reservoir may be divided into four distinct classes.

1. Light sandy soils, with a clay subsoil at a depth of about 2 feet, mixed with particles of disintegrated limestone, which have the effect of rendering the clay friable and the subsoil porous. These soils are of very considerable depth, and constitute the best type of irrigation country. Their mechanical nature is roughly as follows:—

Sand..	67 per cent.
Fine sand and silt	8 ,,
Clay	24 ,,

2. Sandy soils somewhat heavier than the above, with a clay subsoil unmixed with limestone, and which are consequently not quite so open and porous as the first class. These soils are, however, well supplied with lime, and the soil is sufficiently porous to suit irrigation. The mechanical nature of these soils is roughly as follows:—

Sand	53 per cent.
Fine sand and silt	12 ,,
Clay	34 ,,

3. A stiffer type of soil, containing a large proportion of clay, and having the following mechanical composition:—

Sand	17 per cent.
Fine sand, silt, and clay	82 ,,

4. A shallow soil with a sandy surface, changing at 6 inches to 1 foot to a stiffer clay. The mechanical composition of the soils of this class is roughly the following:—

Surface soil (to 6 inches).

Sand	85 per cent.
Fine sand and silt	4½ ,,
Clay	9½ ,,

Subsoil at a depth of 2 feet.

Sand	44 per cent.
Fine sand and silt	7 ,,
Clay	48 ,,

The first two classes may be grouped as first-class irrigation land.

Class 1.—The soil to a depth of about 2 feet is a light sandy loam, friable and easily worked. At 2 feet particles of limestone are mixed with the soil, so that the subsoil, though becoming more clayey, is still quite friable. The soil is rich in lime and potash, and fairly well supplied with

phosphates. It is not very rich in humus, and only poorly supplied with nitrogen, so that green manuring is indicated as being the most effective treatment for the soil, which, under irrigation, should not require any other manuring.

The capillary power of the soil is high, which is a very favourable sign for land which is to be irrigated. The bacterial activity, and especially the nitrifying power, of the soil is high. Analysis shows that the soil is an extremely fertile one, and eminently adapted from its mechanical condition for irrigation.

It appears that water is struck at a depth of about 70 feet, and as the soil is certainly very open and friable to a depth of over 6 feet, it is probable that a considerable quantity of water will have to be applied in the first instance in order to saturate the soil and raise the level of the ground water.

The soil is admirably adapted for citrus fruits, peaches, apricots, and other stone fruits, and for grapes. It would also be very suitable for lucerne and root crops, but rather less suited for wheat and other cereals and fodder crops.

Class 2 is typical of a rather heavier kind of first-class irrigation land. The clay subsoil is unmixed with limestone particles, and is not so porous as the previous type. It is of a chocolate colour, and is unchanged to a depth of about 1 foot 10 inches, when it becomes more clayey. The mechanical analysis shows it to be very similar to the previous class, but containing rather less sand and rather more of the finer particles, silt and clay. As in the previous type, the capillary power is very high. It is chemically a fairly rich soil, well supplied with lime and potash, the proportions of which increase in the subsoil to the depth at which it was examined. Phosphates are fair and humus low, indicating the advantage of green manuring. The bacterial activity in this soil is remarkably vigorous, nitrification setting in and developing very rapidly.

It is adapted for the same crops as the previous class, and should give excellent results under irrigation. It is, however, somewhat inferior to class 1 for irrigation, on account of the finer nature of the particles composing the subsoil, which is stiffer and less pervious.

Class 3.—A stiffer class of land, which may be regarded as second-class irrigation land. It is a stiff clay, and is apparently unchanged in nature to the depth at which the samples were taken (2 feet). Although the proportions of fine silt and clay particles are so large, the presence of lime in considerable quantities renders the clay flocculent, and the soil is not so stiff as the figures might lead one to suppose. At the same time it is not so perfectly suited either to irrigation or to the growth of fruit, such as citrus, peaches, raisin grapes, &c., as are the soils previously discussed.

It is, however, good wheat land. Like the others, it is well supplied with plant-food, with the exception of nitrogen, and particularly rich in lime and potash. It is fairly rich in bacterial life, but the formation and development of nitrates is by no means as vigorous as in the case of the other soils.

Class 4 differs from the others in being much shallower—that is to say, the surface soil, which is very sandy, begins to change at 6 inches, and to become more clayey in character. At the depth of 1 foot, the soil is as clayey in character as the deeper subsoils of the other types of land, and as limestone is absent at the depth at which the samples were taken (about 2 feet 10 inches), the subsoil at 1 foot is already very stiff and impervious, and becomes increasingly so at lower depths.

On account of the shallowness of the surface soil and the stiffness of the subsoil, this land is to be regarded as second-class irrigation land, and is less suited to the production of citrus and drying fruits and grapes.

Unless thoroughly cultivated and properly graded and drained, the effect of continued irrigation on this class of soil would be to form an impervious stratum close to the surface, which would prevent the proper ventilation of the soil and the free development of the roots.

With proper treatment there is no reason why it should not give good results under irrigation, and wheat, fodder crops, and vegetables should all do well. The soil is not quite so well adapted as the others to the growth of the fruit trees specified. Chemically it is a fairly rich soil, rich in potash, fairly well supplied with lime and phosphates, and, like the others, poor in nitrogen.

Green manuring will greatly benefit the soil, both in supplying humus and nitrogen, and in lightening the texture. Its suitability for irrigation would be very greatly enhanced by ploughing under a green crop.

Speaking generally, the situation of the land renders it an ideal area for irrigation, while the natural drainage should be sufficient to render any elaborate drainage system unnecessary.

The soils of the first two classes are extremely fertile soils, and eminently adapted by reason of their mechanical condition to the growth of crops under irrigation, especially for citrus, stone, and drying fruits. They are deep soils of a fairly light texture, with fairly porous and friable subsoils. They are well supplied with mineral plant-food, the amount of potash being exceptionally high. Limestone abounds over the whole area.

The only defect disclosed by chemical examination is the relatively low humus content and the small proportion of nitrogen. This defect will be remedied when the land is brought under cultivation, and particularly by green manuring, which will correct this deficiency, and, at the same time, by supplying a light mulch to the surface soil, prevent the too rapid evaporation of water.

The soils are eminently adapted to the growth of citrus fruit, peaches, apricots, grapes, both table and raisin, lucerne, and in fact any crop suitable to the climate. The heavier soils are good wheat lands, and they are all suited to the growth of fodder crops, vegetables, and root-crops.

The same remarks apply to the soils represented by classes 3 and 4, which should all give good results under irrigation, though by reason of their more clayey nature they are not so eminently adapted to this purpose as are classes 1 and 2.

Analysis of Soils from Barren Jack Irrigation Area.

Distinguishing Mark.	Depth	Colour.	Reaction.	Water Capacity.	Absolute Weight (lb. per acre 6 in. deep).	Capillary Power (inches in 3 hours).	Stones over 5 mm.	Gravel 2 to 5 mm.	Coarse Sand 1 to 2 mm.	Sand ·03 to 1 mm.	Fine Sand ·02 to ·03 mm.	Silt ·01 to ·02 mm.	Fine Silt ·005 to ·01 mm.	Clay below ·005 mm.	Moisture, per cent.	Volatile Matter, per cent.
A	Soil to 6 in.	Red	Acid	36–Fair	1,663,194	in. 10–Excellent	·00	·10	·49	66·98	3·19	2·75	2·92	23·57	2·96	5·20
B	Subsoil of A, 2 ft. to 3 ft.	Light Red	....	..	. . .	5–Fair	1·48	1·75	·43	44·83	2·50	·61	·71	47·69	6·85	11·71
D	Soil to 6 in.	Chocolate	Faintly Acid	41–Fair	1,663,194	10–Excellent	·00	·07	·27	53·37	4·72	3·91	3·22	34·44	4·62	5·77
E	Subsoil of D, 1 ft. 10 in. to 2 ft. 8 in.	Chocolate	....	....	....	4–Fair	·93	1·00	·66	35·99	3·56	4·40	4·40	48·96	9·22	6·60
G	Soil to 6 in.	Chocolate	Alkaline	57–High	1,562,366	10–Excellent	·00	·03	·18	17·43	82·36				6·30	9·89
H	Subsoil of G, 1 ft. to 3 ft.	Chocolate	Alkaline	. . .	..	2·5–Poor	·00	·00	00	12·34	87·66				8·19	7·64
J	Soil to 6 in	Brown	Faintly Acid	34–Low	1,677,137	9–Very good	·00	·17	·67	84·74	1·86	1·35	1·52	9·69	1·47	3·40
K	Subsoil of J, 6 in to 12 in.	Brown	Neutral	29–Very low	1,798,965	10–Excellent	·27	·33	·74	81·59	1·69	·84	1·35	13·19	1·28	2·42
L	Subsoil of J, 12 in. to 24 in.	Brown	Neutral	....	....	6–Good	·09	·15	·54	48·20	2·15	1·61	3·41	43·85	7·10	6·45
M	Subsoil of J, 24 in. to 28 in.	Light Brown	....	....	...	4·5–Fair	·00	·00	·43	44·34	2·38	1·95	2·49	48·41	6·42	7·28

Fertilising Substances.

Distinguishing Mark.	Nitrogen, per cent.	Soluble in Hot Hydrochloric Acid.		
		Lime (CaO), per cent	Potash (K_2O), per cent.	Phosphoric Acid (P_2O_5), per cent.
A	·070–Fair	·562–Good	·279–Good	·142–Satisfactory.
B	·042–Deficient	8·276–Very good	·446–Good	·156–Satisfactory.
D	·070–Fair	·262–Satisfactory	·446–Good	·108–Satisfactory.
E	·028–Deficient	·826–Good	·640–Very good	·155–Satisfactory.
G	·070–Fair	1·758–Very good	·652–Very good	·169–Satisfactory.
H	·028–Deficient	2·349–Very good	·586–Very good	·177–Satisfactory.
J	·042–Deficient	·214–Satisfactory	·204–Good	·124–Satisfactory.
K	·028–Deficient	·270–Satisfactory	·105–Satisfactory	·105–Satisfactory.
L	·028–Deficient	·272–Satisfactory	·418–Good	·144–Satisfactory.
M	·028–Deficient	·254–Satisfactory	·615–Very good	·182–Satisfactory.

Insectivorous Birds of New South Wales.

[Continued from page 400.]

We have received from Mr. Robert Hall, F.L.S., C.M.Z.S., Curator of the Tasmanian Museum, a copy of his little book, "The Useful Birds of Southern Australia," published by T. C. Lothian, Sydney and Melbourne. It contains many interesting and instructive notes on the habits of birds commonly found about our paddocks and orchards, and might with advantage be added to the farm book-case. Mr. Hall is also the author of "A Key to the Birds of Australia" and other standard works of Australian ornithology.

This month we present plates of two robins, which are plentiful about the coastal flats at this time of the year, but which in early spring will retire to the mountains for the purpose of breeding, and be seen no more on the lowlands till next autumn.

5. Scarlet-breasted Robin.

There are seven species of so-called "Red-breasted Robins" in Australia, the shade of the breast varying in the different species. The two birds now illustrated appear about the same time of the year, and may be distinguished by the shades of the breast feathers, and also by the black throat of the Scarlet and the red throat of the Flame-breasted bird. They are both valuable insect-destroyers, and should be encouraged to visit field and orchard—which they will readily do if not interfered with.

The Scarlet-breasted Robin remains longer than his cousin. The white frontal mark on this robin increases in size as the bird grows older, extending on to the crown of the head in very old birds. The female also has a small white frontal spot, and, unlike the female Red-capped Robin, the breast is strongly washed with light scarlet.

Mr. North says:—"The note of the Scarlet-breasted Robin is sweet and low, and is usually uttered when the little songster is perched on the top of a stump, a fence, or a large stone. It may be heard to advantage just before daylight, especially in a clearing in a mountain valley, which often fairly resounds with the notes of these birds as they answer one another from stump to stump where they are perched."

The nest is composed of strips of bark, mosses, and dried grasses, securely woven and held together, lined with cow-hair, opossum fur, feathers, or other soft material, the downy covering of freshly-budded fern fronds being more often used when built, as it generally is, in mountain ranges. The rim of the nest is thick and rounded, and the outside is lightly coated with spider's web, to which small pieces of bark, charred wood, or lichens are attached to suit the surroundings and render discovery more difficult. Sometimes the nest is placed on the top of a horizontal branch, or in the forked limb of a

low tree; sometimes between a piece of projecting bark and the stem of a tree. The site is generally not more than 10 or 12 feet from the ground.

The eggs are usually three, sometimes four, for a sitting, oval or rounded oval, the surface dull and lustreless. The ground colour varies from pale green or bluish white to dull brownish white, some being almost covered with spots or blotches of brown and purplish grey, others sparingly dotted with purplish-brown or lilac-grey. August and the four following months constitute the usual breeding season.

With regard to the food of this bird, Mr. North says:—"Its food consists of insects, principally small moths, butterflies, beetles, flies, and their larvæ, also worms procured about cultivation paddocks and grass lands. It is an extremely familiar bird, and enters orchards and gardens freely in search of food."

6. The Flame-breasted Robin.

Winter ploughing turns up the soil at a time when it is well stocked with worms and larvæ of insects which later on would pupate and leave the farmer a crop of flying troubles. The Flame-breasted Robin arrives at this time, and is at once attracted by the insect food provided by the unconscious plough. The Laughing Jackass, the sombre, cynical friend of the pioneer, rejoices in the liberty accorded him, and hops down almost under the ploughman's feet to snatch a grub or worm. Yet the pretty little robin is helping in his own way as he flits along the furrows. We wish him to be classed with the kookaburra as a useful visitant.

The note of this species is a little trill uttered in three groups of sounds. Dr. L. Holden translates it as "You-may-come, if-you-will, to-the-sea." Mr. R. N. Atkinson gives it as "You-are-not, a-pretty-little-bird, like-me." Both sexes have the same note.

The birds usually build their nests in the charred trunk of a tree, in stunted timber in mountain forests, or in a crevice in a roadside bank. The nest is made of fine strips of bark, fern-down, and grasses, coated with dry mosses or spider webs, lined with cow-hair, opossum fur, or fern-down; and the outer part of the nest is always made to resemble the surroundings. The birds breed in the Blue Mountains, but, unlike the Scarlet-breasted Robins, are rarely seen in the neighbourhood of Sydney during the winter months.

The usual breeding season is September and the four following months, and the eggs are usually three, sometimes four, indistinguishable in appearance from those of the Scarlet-breasted Robin.

Instances are commonly reported of these robins breeding before they have developed their adult plumage, and when both male and female are brown, with no indication of the scarlet breast. It takes a robin at least three years to develop a thoroughly brilliant red.

It will thus be seen that the two species are very similar in habit, and that they are both of economic value to the man on the land. Their annual winter visits to the farms should be welcomed, as, in addition to providing a brilliant display of flitting colours, they act the part of scavengers of the paddocks, which are often replete with hibernating forms of injurious insect-life.

INSECTIVOROUS BIRDS OF NEW SOUTH WALES.
"SCARLET-BREASTED ROBIN."
PETRŒCA LEGGII, *Sharpe*.

INSECTIVOROUS BIRDS OF NEW SOUTH WALES.

"FLAME-BREASTED ROBIN."

PETRŒCA PHŒNICEA, *Gould*.

Some Further Notes on Maize Smut.

T. HARVEY JOHNSTON, M.A., B.Sc., Bureau of Microbiology, Sydney.

In the January number of this *Gazette* there appeared some notes dealing with maize smut, a disease which is rather common throughout the whole of our South Coast district, and which also occurs in the Hunter and Lower Hawkesbury districts. The condition was then regarded as being due to the attacks of the fungus *Ustilago maydis*, Corda (= *U. zeae*, Beckm.), and the short description given applied to the common maize smut of Europe and America. Having studied the descriptions since published by Mr. McAlpine, of the Victorian Agricultural Department, I am prepared to concur in his view: that the disease is really due to another, and very closely allied smut, *Ustilaga reiliana*, Kuhn.*

Mr. McAlpine has shown that in very young smutted cobs, the spores are arranged in groups, instead of singly, as they afterwards come to be. Hence he places *Ustilago reiliana* under the genus *Sorosporium*. It should therefore be known as *Sorosporium reilianum*. The two are almost identical microscopically, but Mr. McAlpine's studies seem to have definitely decided that our pest is not the common European variety.

It is important to notice that *U. reiliana* forms its spores in the heads, and occasionally in the surrounding bracts of the maize, and hence these spores may cling to and be planted with apparently healthy seed. It is, therefore, necessary to emphasise the point previously mentioned, namely, that infection probably occurs during the early seedling stage, as in the case of many other smuts. Consequently the treatment formerly advised, that the seed should be "pickled" before sowing, is the essence of preventive action. In other parts of the world, ½ per cent. solution of bluestone is used for this purpose; but Mr. McAlpine advocates a much stronger solution, namely 2 per cent. This is made by dissolving 1 lb. of sulphate of copper (bluestone) in 5 gallons of water. On account of the increased strength of the "pickle" the seed must not be left in it for more than a minute, otherwise the grain itself would be injured. If the ½ per cent. solution be used—that is, by using 1 lb. bluestone dissolved in 20 to 25 gallons of water, the seed may remain in it for several hours without injury.

As the practice of steeping is not carried out to any extent in maize-growing districts, it will not be out of place to state briefly how it may be done. The same method may also be applied to wheat:—

The bluestone solution should be prepared in a wooden tub, as it is likely to corrode metal vessels. A bag is then placed in the liquid, the mouth being kept open by being attached in some way to the edges of the tub.

* "The Smuts of Australia," 1909, pp. 111, 118; "Journal of Agriculture," Victoria, May, 1910, p. 290.

The seed is then carefully poured into the bag and is stirred, so that every grain becomes moistened by the fungicide. In the case of wheat, bunt balls, if present, will float and may be easily skimmed off. In all cases, any spores which may be adhering to the grain become destroyed by the action of the copper solution. The bag should be removed and allowed to drain, and the seed dried. It should be emphasised that, if the stronger solution be used, the seed should not remain immersed for a period longer than that indicated above.

Ustilago reiliana, or more correctly, *Sorosporium reilianum,* also attacks sorghum in other parts of the world, but does not seem to have been recorded as attacking this host in New South Wales. Another smut, *Ustilago* (*Cintractia*) *sorghi*, Link* occurs in the heads of sorghum in our State. It does not produce any marked distortion of the head, the individual grains, most of which are attacked, becoming discoloured and slightly larger and more projecting than normal.

Trial of Leguminous Plants from Ceylon.

Some time ago Mr. B. Harrison, of Burringbar, Tweed River, supplied the Department of Agriculture with seeds of four leguminous plants from Ceylon, reported to possess fertilising properties, viz.:—*Crotalaria striata*, *C. laburnifolia*, *C. hirsuta* and *Indigofera rubra* (sic).

The first-named is cultivated by the Santals of Chutia Mazpur on account mainly of its fibre; it is also indigenous to Queensland, but is not put to any commercial use, though very common about Brisbane. *C. laburnifolia* is used in parts of India for papermaking, and is also a Queensland plant, growing chiefly on sandy sea-shores. *C. hirsuta* is not known to be put to any economic use; whilst the name *Indigofera rubra* is either antiquated and forgotten or a *nomen nudum*.

The seeds were planted at the Hawkesbury Agricultural College, but two —*Indigofera rubra and Crotalaria laburnifolia*—failed to germinate. The other two germinated, but *Crotalaria hirsuta* is the only variety now living. Three plants have grown to a height of 3 feet, but all are very branched, which necessarily prevents any length of fibre being obtained. The main stalks are very thick and coarse, and would require a large amount of labour to remove the bark. The quantity of fibre present is very small, and as the weather conditions under which the plants were grown were favourable, the variety is considered to possess no commercial value.

The hard and woody nature of growth of the plant, together with the low yield of green stuff compared to cowpea, totally unfits it as a plant useful in green manuring. Even if successfully turned under, it would take too long to decompose. A few nodules were found upon the roots.

* This smut is recorded by Mr. McAlpine as *Cintractia sorghi vulgaris*. Some leading authorities in Europe, however, regard the genus *Cintractia* as being part of the genus *Ustilago*, the distinction between the two genera being very slight.

Farmers' Experiment Plots.

Wheat Experiments, Season 1909.

GEORGE VALDER, Chief Inspector.

For this season it was decided to confine the experiments to variety and manurial trials. Plots were established in four of the five divisions, viz., North, South, West, and South Coast. None were started in the North Coast, but a commencement will be made in this division during the coming season.

The districts where the trials were conducted, and the names of the experimenters, were as follow:—

North.

Armidale—W. G. Higinbotham, Tilbuster.
Breeza—John Perry.
Curlewis—John Campbell, senior, "Glasleck."
Delungra—W. Tonkin, Little Plain.
Glen Innes—Experiment Farm.
Gunnedah—H. Newnham, "Weroona."
Gunnedah—W. McDonald, "Toryburn."
Gunnedah—W. H. Newnham, "Weroona."
Guyra—E. C. Baker, "Shirley."
Kelvin—F. A. Porter.
Manilla—A. T. Veness, Northbrook.
Narrabri—W. Palmer.
Pilliga Scrub—F. J. Wangman, Pilliga Roadside.
Pilliga Scrub—R. Roden, Cumberdeen, Wee Waa.
Quirindi—Smith Pollock.
Tamworth—Thomas Burke.
Tenterfield—J. F. Chick, "Homestead."
Tenterfield—H. H. Willgoose, "Bungulla."
Uralla—L. M. Rixon, Barley Fields.
Warialda—A. T. Smith, Kelly's Gully.

South.

Albury—G. Laidlaw, Elm Park, Jindera.
Berrigan—John Jones, "Pine Hill Farm."
Cooma—M. J. Murry, Glencoe Place, *viâ* Cooma.
Deniliquin—J. Carew, South Deniliquin.
Germanton—Hulme Bros., High Plains, Cookardinia.
Henty—A. Eulenstein.
Jerilderie—S. P. Wilson.
Jindabyne—Sir Joseph Carruthers.
Narrandera—Yanco Experiment Farm.
Queanbeyan—John Reid, Canberra.

Temora—J. Donaldson, junior, Sproule's Lagoon.
Tumbarumba—J. Eisenhauer, Rosewood.
Tumut—Dr. Mason.
Wagga—Wagga Experiment Farm.
Wyalong—R. Gagie, senior.

West.

Bathurst—Bathurst Experiment Farm.
Blayney—H. A. Marsden.
Cobbora—J. Clarke, Dapper, *viâ* Gulgong.
Condobolin—R. Tasker.
Cowra—Cowra Experiment Farm.
Cumnock—C. Miller.
Eugowra—H. C. Piddington.
Gilgandra—J. W. Lithgow.
Grenfell—C. J. Maslin.
Gulgong—W. A. Watt.
Maryvale—Major C. H. Barton, M.L.A.
Millthorpe—W. Prest.
Mudgee—H. Coughey.
Mungeribar—Thomas Bragg.
Narromine—W. O'Neill.
Orange—Agricultural Society.
Parkes—W. I. Nash.
Rylstone—L. Lloyd.
Young—Young and Ralli.

Varieties Grown.

The varieties of wheat sent out by the Department for these trials were as follow:—

1. Bobs.
2. Bunyip.
3. Cleveland.
4. Comeback.
5. Federation.
6. Firbank.
7. Florence.
8. Genoa.
9. John Brown.
10. Jonathan.
11. Rymer.
12. Sussex.
13. Thew.
14. Uppercut.
15. Warren.
16. Whiteloaf.

The varieties supplied by the farmers experimenting as being the best they had so far tried were:—

Allora Spring.
Budd's Early.
Chant's Prolific.
Club Head.
Dart's Imperial.
Hudson's Purple Straw.
Manitoba.
Marshall's No. 3.
Pioneer.
Plover.
Purple Straw.
Steinwedel.
Turvey's Purple Straw.
Yandilla King.

The rule was observed that if possible only one plot should be placed in each district. This was made necessary in consequence of the large number of applications for plots, and the difficulty of controlling more than a limited number.

In some cases, however, it was found necessary to establish more than one plot in a district. For instance, it may be found desirable to experiment in a certain district at the one time with wheat and other cereals, forage plants, and grasses; and in order to give these a fair trial on average land it may be necessary not only to pick three different classes of soil, but, in order to get these, to have the plots on three farms widely separated; hence we get three plots in one district.

Most of the plots were ½-acre ones, the usual size being 10 chains long by ½ a chain wide; but with paddocks 20 chains in length acre plots were put in—*i.e.*, 20 x ½; and where a length of 40 chains was obtainable they were made 2 acres—*i.e.*, 40 x ½.

Farmers experimenting usually prefer acre plots, and the Department also favours these; but the difficulty is that in most cases it is impossible, in order to get a fair comparison, to make the plots wider than ½ a chain. The land varies very much in quality in a short distance, and as few paddocks allow of more than a 10-chain run in length, the plots have to be made ½ acres.

The following is the plan upon which the experiment plots were laid out:—

							½ chain.								
10 Chains.	Farmer's Variety.	Federation.	Comeback.	Bobs.	Farmer's Variety.	Bunyip.	Florence.	Genoa.	Farmer's Variety. No manure.	Farmer's Variety. 28 lb. superphosphate.	Farmer's Variety. 21 lb. superphosphate ; 7 lb. sulphate of potash.	Federation. No manure.	Federation. 28 lb. superphosphate.	Federation. 21 lb. superphosphate ; 7 lb. sulphate of Potash.	10 Chains.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	

Each plot, half-acre.

From this it will be seen that there are fourteen plots. The general rule adopted for a variety test was to pit, say, six varieties approved by the Department against the best local variety. In visiting the district the

Inspector asks the farmers what variety of wheat has given the best results: generally there is a favourite, often either Dart's Imperial or Chant's Prolific, and this wheat is used as the check variety. With the six Departmental varieties the general plan adopted was to select three tried varieties, such as Federation, Comeback, and Bobs for the first trial, and three newer varieties, such as Bunyip, Florence, and Genoa, for the second trial, putting a check plot of the farmers' variety in between these two trials as indicated in the plan, Plots 1 to 9. This had to vary, however, according to the district, as the varieties given are those used for warm climates, and in the case of a cool climate quite different varieties had to be sown.

The manure trial was confined to one plot with superphosphate at the rate of 56 lb. per acre, one plot with 42 lb. of superphosphate and 14 lb. sulphate of potash, and a plot with no manure. This was duplicated, two varieties of wheat being used, generally the farmer's variety and one of the Departmental varieties, so that a check might be obtained.

The plots were all sown during the months of April and May. The season proved to be a remarkably suitable one for wheat-growing, and generally the results obtained were far in excess of even the most sanguine expectations. The only failure out of the large number sown were the Cooma and Jindabyne plots. This was due to the drought, severe frosts, and heavy winds. The season was one of the worst experienced in this district, with the result that the crops on these two plots did not mature their grain, and only yielded a very small quantity of hay.

So strong was the growth on most of the plots that it was found necessary to feed the crops off with sheep, and in several instances this had to be done a second and even a third time. The result of this was satisfactory in every case.

The attached folding table gives the total yield from all the plots.

An analysis of this table shows that the following were the average yields of the varieties sown in four or more plots :—

Variety.	Average yield. bushels	lb.	Number of trials.
1. Federation	24	23	31
2. Warren	22	4	4
3. Florence...	21	52	13
4. Rymer	20	53	24
5. Bunyip	20	22	25
6. Thew	20	16	27
7. Comeback	20	11	31
8. Whiteloaf	19	22	4
9. Bobs	18	52	30
10. Firbank...	18	51	4
11. Genoa	17	6	11
12. Cleveland	16	54	6
13. John Brown	16	31	9
14. Jonathan	13	44	8
Farmers' Varieties	19	18	34

Although it is hardly fair to draw conclusions from one season's experiments, the following few notes regarding the results obtained from the different varieties will be of interest.

Federation easily takes first place, with an average of 24 bushels 23 lb. in the thirty-one trials. Its superiority was especially demonstrated in the Southern Division, where it averaged 27 bushels 49 lb., as against the next best, Bunyip, with 20 bushels 49 lb. In the Western Division it also came first, with an average yield of 23 bushels 39 lb., Comeback being second with 20 bushels 18 lb. In the Northern Division, it came second with 22 bushels 41 lb. per acre, Florence being first with 23 bushels 28 lb.

View of the Orange Farmers' Plots, showing the fine growth made by the wheat and oats crops.

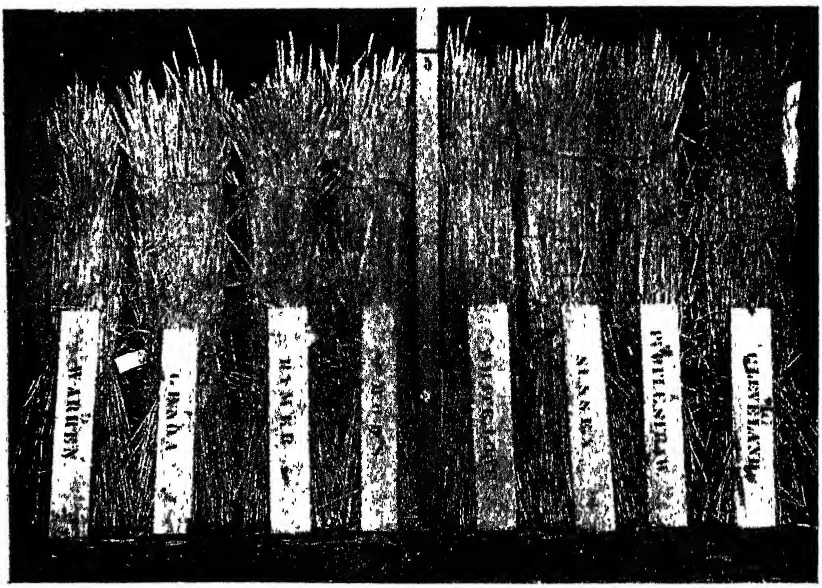
This variety gave record crops of 40 bushels per acre at Albury, without manure, 41 bushels at Germanton with 56 lb. superphosphates per acre, and 44 bushels per acre at Germanton and 40 bushels at Wyalong with 42 lb. superphosphate and 14 lb. of sulphate of potash per acre. These four highest yields were all obtained in the Southern Division.

It took first place at Albury, Germanton, Henty, Berrigan, Deniliquin, Temora, and Wyalong, in the Southern Division; at Maryvale, Eugowra, Parkes, Mungeribar, and Young, in the Western Division; and at Manilla, in the Northern Division.

The following table also shows that Federation proved vastly superior in yield to the Farmers' varieties of the old Purple Straw type:—

	Federation.	Farmers' Varieties.
Southern Division ...	27 bushels 49 lb.	21 bushels 23 lb.
Western „ ...	23 „ 39 „	18 „ 47 „
Northern „ ...	22 „ 41 „	18 „ 12 „

Warren.—Although this wheat came second in the averages, it was only tried in four places, and therefore it can hardly be compared with the other varieties, which were tried in a large number of plots. Still, it gave really good results in all of the four trials, though it did not come first in any.



Specimen sheaves of 8 varieties of wheat grown on the Orange Farmers' Plots. Yield, 13 to 28 bushels per acre.

Florence.—Although placed third in the list, it should really be regarded as second only to Federation, as it was tried in a much larger number of plots than Warren. Of the new varieties used in these trials, it proved to be the best yielder, and was very highly spoken of by many farmers who inspected the plots, both as a grain and hay wheat. It proved especially suitable for the Northern Division, where it came first in average yield with 23 bushels 28 lb. per acre. It was first in yield at Narrabri, in the North-West, and at Dapper, in the West.

As a result of its success there was a great demand for seed for this season, but supplies were very limited, and all stocks were sold out early in the season.

Rymer.—This variety was a close fourth, with an average of 20 bushels 53 lb. per acre in twenty-four trials. This appears to be a very reliable cropper, coming first at Quirindi and Mudgee, and giving a good yield at all the places in which it was tried. It appeared to be specially suited to the Western and North-Western districts, where it came third in the average yield.

Bunyip.—Though fifth in the list, Bunyip was described by many of the farmers who grew it to be one of the most promising varieties yet introduced. Its robust growth, medium-length straw, earliness, and heavy yield of fine, full grain, make it a very popular variety both for grain and hay. The demand for seed of this variety was also greatly in excess of the supply, and very heavy prices were paid for it.

It came first at Jerilderie, Gilgandra, Condobolin, Grenfell, and Cumnock.

Thew.—This proved to be a good cropper, especially in the Northern Division, coming first at Wee Waa, Warialda, Curlewis, Tamworth, and Uralla. It also came first at Narromine and Gulgong, in the Western Division.

Complaints were received about its being a weak-strawed variety; and as the flour from it is also classed as weak, this variety is not recommended for the wheat-growing areas.

It proved, however, to be the best variety grown during the past season for producing green fodder and hay in the coastal districts, yielding very heavy crops, and, in consequence of its earliness, escaping rust.

Comeback again gave satisfactory results, coming second to Federation in the average yields in the Western Division, and taking first place at Kelvin and Gunnedah, in the North-West. It appears to be particularly well suited to this latter district.

Both as a hay and grain wheat it is very highly spoken of by farmers.

Whiteloaf was only tried in four districts. It gave fairly satisfactory results, and is certainly worthy of further trial.

Bobs.—During this season this variety did not do as well as expected, but the average returns show that it gave a slightly better yield than the Farmers' varieties, and as it is such a favourite with the millers, I consider that its cultivation should still be encouraged.

Firbank proved to be one of the most promising of the new wheats as a hay producer, but did not come very high in the average yields of grain. It was only tried in four plots, however, and may yet prove to be a suitable grain producer in some districts.

Genoa, another new variety, proved somewhat disappointing in comparison with Florence, but gave satisfactory results in the North-Western districts, and came first at Gunnedah.

Cleveland was only tried in the cooler districts; and as the yields in these districts were generally low, it came low in the average; but it took first place at Queanbeyan and Millthorpe, and may be regarded as one of the best varieties for the cooler wheat-growing districts, both for hay and grain.

John Brown.—Although rather low in the average yields, this variety gave wonderfully good returns in certain districts, coming first in order at Breeza, Rylstone, Blayney, and Armidale.

Jonathan, like Cleveland, was only tried in the cooler districts, and hence its low position in the averages.

Of the varieties tried on a small scale, Sussex, Bayah, Haynes' Blue Stem, and Yandilla King proved very promising. Sussex, in the only two trials made, came top in each. Haynes' Blue Stem was top at Tenterfield, Bayah at Bathurst, and Yandilla King at Wagga. These are being given more extensive trials this season.

Manurial Trials.

It will be seen that seventy manurial trials were made, each trial consisting of three plots, namely: (1.) No manure; (2.) 56 lb. superphosphate per acre, costing 2s. 6d.; (3.) 42 lb. superphosphate and 14 lb. sulphate of potash per acre, costing 3s. 6d.

The average of these seventy plots was as follows:—

	Bushels	lb.
1. No manure ...	18	53
2. Superphosphate ...	20	45
3. Superphosphate and potash ...	21	17

This shows an average gain of nearly 2 bushels of wheat by the use of superphosphate to the value of 2s. 6d. per acre, and of nearly 2½ bushels by the use of superphosphate and potash to the value of 3s. 6d. per acre. The gains by the use of manure ranged to as much as 14 bushels per acre.

Only in a few instances was there any loss occasioned in using the manure, and in several of these the loss was due to the manure being broadcasted, owing to a drill being unprocurable.

The losses which did occur were on one or two of the plots situated on the black soils of the North-West, such as at Delungra, and on rich soils in the west, such as that at Narromine. Even at these places, however, the evidence obtained was somewhat contradictory, and further manurial experiments will be made at these places this season.

Wheat Experiments in the Northern Division.

W. R. FRY, Acting Inspector of Agriculture.

THE wheat experiments initiated in the Northern Division were conducted on sixteen farms, and comprised fifteen grain trials, and one hay trial. Those from the North-West were sown from the middle of April to the end of May, and those in New England during June.

Most of the plots were sown with a seed drill, but where this was unobtainable the cultivator and seeder combined was used, or the seed was broadcasted, and harrowed or ploughed in.

Only one of the plots (Manilla) was sown on fallowed land, and one (Narrabri) on newly cleared land. All the other land under trial in the North-West district has been regularly cropped with wheat for a number of years without manuring.

The rainfall during the growing period was rather too abundant, promoting a rank growth, which was especially favourable for the development of rust.

Two of the Farmers' plots (Breeza and Gunnedah) were fed off by sheep during July, and again during August, and the ultimate grain yield was greater than adjacent crops that were not fed off.

Owing to the excessive rainfall the plots were more or less attacked by rust, but the grain was not materially affected, all samples being saleable.

The detailed yield of each variety can be seen on reference to the completed tabulated report, but the average yield of varieties in the Northern Division were as follow:—

Variety.	Average yield. Bushels	lb.	Number of trials.
Florence	23	28	6
Federation	22	41	11
Rymer	22	23	8
Comeback	20	55	12
Thew	20	53	14
John Brown	20	46	5
Bunyip	20	42	8
Bobs	19	36	9
Genoa	17	20	3
Farmers' Varieties	18	12	10

It will be noticed that eight of the Departmental wheats returned a higher average yield than the Farmers' varieties. In only one instance, namely, at Manilla, did the yield of the Farmers' variety exceed that of the Departmental wheats under trial. The variety used in this case was Steinwedel.

Among the new Departmental varieties, Florence promises to be a most valuable introduction, being particularly rust and bunt resistant. It is an upstanding and early wheat, and appears to be particularly suited to the Narrabri district, where it yielded over 30 bushels per acre.

Rymer and John Brown maintained their reputations as prolific, upstanding, storm-resisting wheats, and appear to be especially suitable for the black soils around Breeza and Quirindi.

Federation gave an average yield of over 22 bushels per acre from eleven plots, yielding up to nearly 32 bushels on several plots. The exceptionally wet season, however, was not suitable for this prolific, drought-resisting variety, some farmers' crops being so badly pinched by rust that millers offered lower prices for the grain.

The average yield of Thew wheat, from fourteen plots, was nearly 21 bushels. At Wee Waa it yielded nearly 36 bushels per acre. It is, however, very weak in straw, and went down badly in places from storms. As

it is also of low flour strength, it cannot be recommended for extensive cultivation in this district.

Comeback gave an average return of nearly 21 bushels per acre from twelve plots in the North-West, yielding up to 33½ bushels at Wee Waa. This wheat is becoming a great favourite in the Narrabri district, yielding either grain of superior quality, or excellent hay. When sown too early, it was liable to damage from frosts, and, where allowed to grow too high, it went down.

Bunyip gave an average yield of nearly 21 bushels per acre, yielding over 34½ bushels per acre at Wee Waa. Owing to the wet season, however, this variety was affected by rust, and being rather a slow grower, was, at first, in some of the plots—especially at Kelvin—considerably checked by black oats and weeds.

Bobs yielded up to 34½ bushels per acre at Warialda, and averaged 19 bushels 36 lb. per acre over nine plots. In the warmer districts, it was noticed that plots sown with Bobs seed supplied from the Glen Innes Experiment Farm were later in maturing than Bobs locally-grown. It was also noticed that much of the so-called local Bobs wheat consisted of a mixture of Jonathan and other varieties. This admixture has affected the reputation of the variety.

In the North-West district, all the plots were harvested with a stripper or harvester drawn by horses or bullocks, but in New England they were cut with a reaper and binder and threshed. Continuous rain whilst the wheat was in stooks considerably affected the results from these plots. It was proved, however, that Haynes' Blue Stem (a Manitoba variety), Jonathan, and John Brown, are prolific and profitable wheats for those localities. The Tenterfield miller is now offering an increased price for these improved varieties over that offered for the White Velvet Pearl variety, which has hitherto been grown there.

The accounts rendered for controlling the farmers' plots in the New England districts also prove that many of the operations are conducted on too small, and, therefore, too expensive a scale, for profitable wheat-farming. By the use of multiple ploughs, wider harrows, and better methods of threshing, and in some cases the application of fertilisers, the New England farmers can profitably produce wheat of the Manitoba and stronger types equal to that from any part of the State.

In the manurial trials, an increased yield was obtained in most cases where the manure was applied with a drill, but where the fertiliser was merely broadcasted, very little difference was recorded. The increase due to manuring (drilled) ranged from 2 bushels up to 5½ bushels per acre at Narrabri, in the North-West, and up to 7 bushels at Uralla, in New England district.

On the north-western slopes and plains there are up to date over 250,000 acres under cultivation, as compared with 220,000 acres last year, there being an increase of 10,000 acres in the Boggabri police district alone. With

the development of Pilliga Scrub there is every indication of a considerable increase of wheat lands in the Narrabri district. As most of this cultivation area is comparatively new, very little fallowing or manuring has yet been practised. This season, however, some wheat-growers have obtained fertiliser drills, and there is no doubt that the results of some of the experiments have encouraged them to do so. It is true that on some of the stronger soils the excessive rains caused some of the manured plots to go down, so that very little increased grain was harvested; and in one case—Delungra—an actual decrease resulted. It is hoped, however, to continue these manurial experiments during a season of less abundant rainfall.

Further definite information on the effect of fertilising strong soils would be very instructive. The experiments proved that on the granitic and sandy soils the application of fertiliser was exceedingly profitable.

Most of the farmers conducting the experiments have offered to continue the plots this season, whilst many additional offers have been received.

It was noted that in some few cases where the operations were left to the farmers, the results were not altogether satisfactory. This appeared to be due to the fact that the practical farmer is accustomed to put in large areas, and to work for a large profitable return, and has not received the necessary training for accurate experiment work. Some farmers' experiments which I inspected, and which were initiated and conducted by the farmers themselves, were utterly useless for comparative information, owing to the neglect of some absolutely important details. To obtain accurate and reliable results, it is necessary for the experiments or districts to be so arranged that the inspectors can certify to or supervise all the operations.

Local farmers, in the majority of cases, exhibited great interest in the experiments, and many inquiries have been received by the experimenters and the Department for seed of those varieties that have proved themselves superior to local varieties. The general opinion expressed is that the Farmers' experiment plots are the most practical educational system yet initiated by the Department of Agriculture, and there is every evidence of the interest being maintained.

Wheat Experiments in the Southern Division.

HUGH ROSS, Inspector of Agriculture.

AREAS of 10 acres were laid out in different districts, and strips of half an acre were sown with varieties of wheat recommended by the Department. These were tested against each other, and also against what the farmer considered to be his best variety. While the object has not been to aim at

records, still some remarkably fine yields were obtained. The following list gives the average yields of the principal varieties used in the experiments:—

Variety.	Average yield. Bushels	lb.	Number of trials.
Federation	27	49	8
Bunyip	20	19	7
Florence	20	46	4
Bobs	20	39	6
Rymer	19	59	5
Thew	18	58	3
Comeback	18	55	8
Farmers' Varieties...	21	23	9

From the foregoing figures it will be seen that Federation easily holds the premier position as a grain wheat in the Southern Division. It yielded the fine average of 27 bushels 49 lb. per acre in eight trials, over 40 bushels being obtained at Albury.

A few comparisons between the best of the Departmental varieties and the best Farmers' variety may prove of interest.

At Albury, the Departmental variety Federation went 40 bushels per acre, while the Farmers' variety, Dart's Imperial, yielded only 25 bushels.

At Germanton and Wyalong the Farmers' varieties, Club Head and Dart's Imperial, yielded 27 bushels 28 lb. and 30 bushels 21 lb. per acre, respectively, while Federation yielded 36 bushels 12 lb. and 35 bushels 59 lb.

An increase of over 11 bushels per acre is noticeable in the field at Deniliquin, for, while Dart's Imperial in that locality yielded only 15½ bushels, Federation yielded over 26½ bushels per acre. In the same plot, half an acre of Bunyip sown on fallowed land resulted in a yield of 17 bushels 40 lb. per acre of clean grain, whereas a similar area of non-fallowed land yielded at the rate of only 12 bushels per acre, and the grain was dirty with wild oats.

It is noteworthy that in not one single instance has the Farmers' variety given as good results as the Department's wheat, and it is indeed a matter for congratulation that our own State should have been able to create varieties of wheat which excel all others not only in regard to yield, but also in milling qualities.

Besides variety trials, manure tests have also been carried out in each field, and these afford some interesting information. Trials were conducted on land unmanured, land manured with 56 lb. superphosphate per acre, and land manured with 42 lb. of superphosphate and 14 lb. of sulphate of potash per acre.

The returns of the manurial trials showed a substantial increase in yield as the result of an application of ½ cwt. of superphosphate per acre; roughly speaking, at a cost of 2s. 6d. per acre. In comparing the yields of the various plots, we find that at Germanton the addition of the manure had the effect of increasing the yield by as much as 14 bushels per acre; at Henty by 8 bushels; at Temora by 6 bushels; and in the eight districts the average increase amounted to 5 bushels per acre.

Whether the addition of 14 lb. of sulphate of potash per acre is a practice which the farmers in the Southern Division should follow, is a question that cannot be answered by the results of one year's experiments. In most cases its application this season has resulted in an increased yield, but on the other hand, in one or two instances, the results have been negative.

In order to encourage farmers in cool districts, where hitherto little wheat has been grown, and also to demonstrate that certain varieties are essentially suited for cool climates, an experiment plot was established in the Queanbeyan district on the farm of Mr. John Reid, Canberra. The results are highly satisfactory, some varieties again showing a marked superiority over others, under identical soil and climatic conditions. The result of this experiment is as follows:—

Number of Plot.	Variety.	Yield. Bushels	lb.
1.	Whiteloaf	14	54
2.	Genoa	20	50
3.	Warren	21	0
4.	Cleveland	23	44
5.	Bobs	22	12
6.	Purple Straw (Farmers' Variety)	21	20
7.	Cleveland (sown with 56 lb. superphosphate)	21	20
8.	Cleveland (no manure)	18	0
9.	Cleveland (sown with 42 lb. superphosphate and 14 lb. sulphate of potash)	20	40

The experiments right throughout my district have been watched with keen interest, not only by the experimenters, but by farmers in the various districts. In all cases the work has been carried out by the farmers faithfully and conscientiously.

With the co-operation of practical farmers in establishing demonstration plots in their own districts on their own farms, the man on the land is brought into closer contact with the Department of Agriculture and its officers; and this close relationship cannot fail to leave good effects behind it. By continuing these experiments, and bringing before the farmers' notice from time to time new and more prolific varieties of wheat and cereals, it is confidently expected to effect substantial and lasting improvement in the wheat yield of this State.

Wheat Experiments in the Western Division.

MARK REYNOLDS, Inspector of Agriculture.

THE experiment plots in the Western Division numbered eighteen, and embraced the Central Tablelands and the Western Plains. Half-acre, acre, and 2-acre plots, depending upon the size of the paddocks available, were sown with varieties recommended by the Department. They were tested

Wheat Yields, Experiment Plots, Season 1909.

Variety.	Narrabri.	Wee Waa.	Manilla.	Warialda.	Delungra.	Kelvin.	Breeza.	Gunnedah No. 1.	Gunnedah No. 2.	Uralla.	Curlewis.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Australian Lammas	...	...	...	...	...	...	...	...	...	...	...
Bayah	...	...	...	...	...	...	...	...	...	...	...
Bobs	13 20	20 48	...	34 38	18 30	10 22	...	17 36	22 38	...	15 36
Bunyip	22 2	34 42	19 0	30 36	...	5 12	...	17 57	17 57	...	18 14
Cedar	...	...	...	...	...	...	...	...	...	...	...
Cleveland	...	...	...	...	...	...	...	...	...	...	...
Comeback	15 40	33 28	...	20 58	18 34	17 40	27 36	15 24	24 38	...	10 11
Cowra White Lammas	...	...	...	...	...	...	...	...	...	...	...
Federation	24 36	31 40	22 52	...	21 44	14 12	28 8	20 0	17 14	...	20 0
Firbank	...	...	...	...	...	...	...	...	...	...	...
Florence	30 24	30 58	21 22	...	...	12 14	25 45	...	20 10	...	...
Genoa	...	...	...	...	...	...	...	21 16	...	...	...
Haynes' Blue Stem	...	...	...	...	...	...	...	...	...	...	...
Huguenot	...	...	...	...	...	...	...	...	...	...	...
Jonathan	...	...	...	...	22 6	...	...	...	...	15 50	...
John Brown	...	...	...	...	20 8	...	29 51	...	...	17 14	...
Plover	...	...	...	...	...	...	...	...	...	...	...
Rymer	...	...	22 4	30 8	...	...	23 4	17 24	14 50	...	17 56
Sussex	...	...	...	...	22 20	...	...	...	...	...	...
Thew	19 0	35 48	20 20	36 54	...	11 5	24 19	20 22	23 30	18 18	20 14
Uppercut	...	...	...	...	...	...	...	...	...	14 56	...
Warren	...	...	...	...	...	...	...	...	...	...	...
Whiteloaf	...	...	...	...	...	...	...	...	...	16 52	...
Yandilla King	...	...	...	...	...	...	...	...	...	...	...
Zealand	...	...	...	...	...	...	...	...	...	...	...
Farmers' Variety	19 28	...	25 0	...	19 43	12 55	21 9	14 12	13 24	...	18 37
Farmers' Variety—											
No Manure	16 40	35 4	21 46	30 8	20 20	12 8	25 25	20 20	14 52	...	15 20
Superphosphate	21 32	36 12	22 56	29 36	18 14	16 21	26 37	11 44	16 14	...	16 2
Superphosphate and Potash	22 8	38 48	23 34	27 36	19 4	13 0	26 0	11 36	16 44	...	17 28
Departmental Variety—											
No Manure	13 28	30 24	21 24	23 8	26 8	15 48	25 25	20 40	11 48	8 56	18 5
Superphosphate	16 14	31 2	22 17	24 20	25 35	16 42	28 37	21 0	13 40	15 50	17 30
Superphosphate and Potash	15 8	31 20	23 10	24 12	24 1	18 4	27 26	19 48	11 48	14 0	19 40

Variety.	Armidale.	Tamworth.	Tenterfield.	Quirindi.	Jerilderie.	Berrigan.	Wyalong.	Temora.	Deniliquin.	Albury.	Queanbeyan.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Australian Lammas	...	...	...	...	...	...	...	...	...	...	...
Bayah	...	...	...	...	...	...	...	...	...	...	...
Bobs	...	13 56	...	...	10 54	15 36	25 10	...	...	26 50	22 12
Bunyip	...	...	...	...	22 24	...	19 40	18 22	17 40	24 30	...
Cedar	...	...	...	...	...	...	...	...	...	...	...
Cleveland	...	...	...	...	...	...	...	...	...	...	23 41
Comeback	10 54	23 36	17 18	...	21 56	11 40	28 30	18 22	14 20	18 8	...
Cowra White Lammas	...	...	...	...	...	...	...	...	...	...	...
Federation	...	17 42	...	31 24	19 56	20 24	35 59	21 42	26 40	40 4	...
Firbank	...	...	...	...	...	...	...	...	7 20	...	...
Florence	...	...	...	...	...	12 12	...	...	...	19 0	...
Genoa	...	14 12	...	16 33	...	...	...	...	...	...	20 50
Haynes' Blue Stem	...	...	22 0	...	...	...	...	...	...	...	...
Huguenot	...	...	...	...	...	...	...	...	...	...	...
Jonathan	15 12	...	17 44	...	...	...	...	...	...	...	...
John Brown	16 40	...	...	20 0	...	...	...	...	...	...	...
Plover	...	...	...	...	...	...	...	...	...	...	...
Rymer	...	21 52	...	31 51	20 24	11 48	...	18 28	...	...	...
Sussex	...	...	...	...	...	...	...	...	...	...	...
Thew	8 22	27 35	11 0	15 0	...	...	25 44	18 0	...	...	...
Uppercut	...	...	...	...	...	...	...	...	...	...	...
Warren	...	...	...	...	...	...	...	...	...	...	21 0
Whiteloaf	...	...	...	...	...	...	...	...	...	...	14 54
Yandilla King	...	...	...	...	...	...	...	...	...	...	...
Zealand	...	...	...	...	...	...	...	...	...	...	...
Farmers' Variety	...	17 21	...	20 10	18 55	16 34	30 21	10 58	15 30	25 15	21 20
Farmers' Variety—											
No Manure	...	19 15	...	...	...	...	...	...	...	...	...
Superphosphate	...	20 3	...	...	...	...	...	...	...	...	...
Superphosphate and Potash	...	18 47	...	...	...	...	...	...	...	...	...
Departmental Variety—											
No Manure	...	16 47	...	22 36	21 30 24 52	9 14	33 0 24 28	15 52 18 0	18 50 12 30	33 4 20 38	18 0
Superphosphate	...	17 47	...	22 15	20 2 26 44	9 48	39 35 27 44	21 56 15 54	24 26 15 40	35 6 23 4	21 20
Superphosphate and Potash	...	18 47	...	23 45	21 16 25 24	12 3	40 25 28 0	19 16 18 46	30 40 16 10	37 0 23 44	20 40

Variety.	Henty.	Germanton.	Narromine.	Maryvale.	Parkes.	Eugowra.	Gilgandra.	Young.	Condobolin.	Mongernar.	Grenfell.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Australian Lammas	...	...	...	...	...	...	...	...	...	...	...
Bayah	...	...	...	...	...	...	...	...	...	...	...
Bobs	...	23 12	17 17	25 25	23 34	23 38	9 46	22 0	7 40	18 19	27 0
Bunyip	14 30	28 42	18 25	10 14	21 42	10 10	15 48	21 10	11 53	20 33	31 58
Cedar	...	...	...	...	...	...	...	...	...	...	...
Cleveland	...	...	...	...	...	...	...	...	...	...	...
Comeback	15 0	23 30	10 23	18 27	23 20	23 0	11 46	22 10	11 14	22 42	33 0
Cowra White Lammas	...	...	...	...	...	...	...	...	...	...	...
Federation	21 36	36 12	21 23	30 32	28 11	30 10	14 14	29 0	8 33	26 31	33 0
Firbank	...	...	...	16 30	...	...	...	...	...	...	...
Florence	18 58	...	...	20 4	...	...	...	...	...	...	...
Genoa	...	...	...	...	...	...	...	...	...	...	...
Haynes' Blue Stem	...	...	...	...	...	...	...	...	...	...	...
Huguenot	...	...	...	...	...	...	...	...	...	...	...
Jonathan	...	...	...	...	...	...	...	...	...	...	...
John Brown	...	...	...	...	...	...	...	...	...	...	...
Plover	...	...	...	...	...	...	...	...	...	...	...
Rymer	19 10	30 6	15 50	30 31	26 20	...	...	19 7	...	22 7	25 0
Sussex	...	...	...	...	...	...	...	...	...	...	...
Thew	13 10	...	23 0	23 20	22 45	...	...	20 46	...	14 30	20 36
Uppercut	...	...	...	...	...	...	...	...	...	...	...
Warren	...	...	...	...	...	...	...	...	...	...	...
Whiteloaf	...	...	...	...	...	...	...	...	...	...	...
Yandilla King	...	...	...	...	...	...	...	...	...	...	...
Zealand	...	...	...	...	...	...	...	...	...	...	...
Farmers' Variety	17 13	27 28	13 52	25 6	27 34	27 20	14 46	23 48	...	20 35	28 41
Farmers' Variety—											
No Manure	...	...	14 5	22 35	26 45	23 20	14 28	19 47	...	22 40	22 30
Superphosphate	...	...	12 24	27 45	31 54	25 28	14 8	22 4	...	19 47	28 29
Superphosphate and Potash	...	...	11 36	26 20	30 37	27 52	10 8	23 27	...	24 2	32 12
Departmental Variety—											
No Manure	10 21 16 58	30 4 18 30	24 51	21 34	24 20	21 0	15 32	26 12	...	18 47	25 18
Superphosphate	18 54 20 14	41 14 26 46	17 58	23 41	24 46	24 50	11 48	20 35	...	11 42	22 52
Superphosphate and Potash	18 58 26 8	44 4 27 6	18 53	24 30	27 11	24 12	12 48	33 0	5 18	18 32	38 20

Variety.	Rylstone.	Mudgee.	Blayney.	Orange.	Millthorpe.	Gulgong.	Dapper.	Cumnock.	Wagga.	Bathurst.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Australian Lammas	...	...	...	...	...	...	...	...	...	11 20
Bayah	...	...	...	...	...	...	...	...	30 44	22 37
Bobs	6 0	13 38	...	17 10	9 2	22 0	...	22 33	...	...
Bunyip	...	...	...	...	...	...	...	21 25	...	...
Cedar	...	...	...	...	...	...	...	...	34 3	18 38
Cleveland	6 13	15 28	...	26 40	14 20	...	...	...	...	14 54
Comeback	...	...	...	...	...	...	19 34	21 33	...	...
Cowra White Lammas	...	...	...	...	...	...	...	...	26 34	16 52
Federation	...	...	...	...	...	22 10	18 16	21 52	...	...
Firbank	...	...	...	...	...	...	...	...	34 1	17 34
Florence	...	...	...	...	...	...	21 54	...	32 55	18 28
Genoa	...	15 2	13 4	21 52	11 40	20 0	15 12	...	...	18 24
Haynes' Blue Stem	...	...	...	...	...	...	...	...	...	...
Huguenot	...	...	...	...	...	...	...	...	26 15	...
Jonathan	6 55	14 22	7 32	...	10 13	...	...	...	...	...
John Brown	10 2	12 20	14 48	...	7 38	...	...	...	...	...
Plover	...	...	...	...	...	...	...	...	20 29	...
Rymer	...	15 55	...	13 15	11 2	22 57	19 54	...	...	...
Sussex	...	...	...	28 0	...	...	...	...	...	...
Thew	...	...	9 24	...	...	23 20	21 49	...	...	18 37
Uppercut	...	...	...	14 26	...	...	...	...	...	...
Warren	...	...	...	18 24	...	...	...	...	29 34	19 18
Whiteloaf	...	...	...	17 42	...	...	...	...	28 1	...
Yandilla King	...	...	...	...	...	...	...	...	35 7	...
Zealand	...	...	...	...	...	...	...	...	28 6	...
Farmers' Variety	8 16	17 21	...	16 20	13 3	18 23	9 17	17 31	...	...
Farmers' Variety—										
No Manure	...	22 31	...	16 44	5 0	15 6	8 11	11 36	...	...
Superphosphate	2 40	21 15	...	19 14	8 45	18 0	11 1	20 58	...	...
Superphosphate and Potash	3 31	20 49	...	21 44	10 40	19 23	10 32	14 1	...	...
Departmental Variety—										
No Manure	6 20	16 35	18 33	28 57	8 30	...	13 59	19 28	...	...
Superphosphate	9 12	17 12	19 51	29 43	22 15	...	16 47	28 30	...	...
Superphosphate and Potash	10 15	18 15	20 16	31 44	10 52	...	20 7	25 16	...	...

Inspector asks the farmers what variety of wheat has given the best results; generally there is a favourite, often either Dart's Imperial or Chant's Prolific, and this wheat is used as the check variety. With the six Departmental varieties the general plan adopted was to select three tried varieties, such as Federation, Comeback, and Bobs for the first trial, and three newer varieties, such as Bunyip, Florence, and Genoa, for the second trial, putting a check plot of the farmers' variety in between these two trials as indicated in the plan, Plots 1 to 9. This had to vary, however, according to the district, as the varieties given are those used for warm climates, and in the case of a cool climate quite different varieties had to be sown.

The manure trial was confined to one plot with superphosphate at the rate of 56 lb. per acre, one plot with 42 lb. of superphosphate and 14 lb. sulphate of potash, and a plot with no manure. This was duplicated, two varieties of wheat being used, generally the farmer's variety and one of the Departmental varieties, so that a check might be obtained.

The plots were all sown during the months of April and May. The season proved to be a remarkably suitable one for wheat-growing, and generally the results obtained were far in excess of even the most sanguine expectations. The only failure out of the large number sown were the Cooma and Jindabyne plots. This was due to the drought, severe frosts, and heavy winds. The season was one of the worst experienced in this district, with the result that the crops on these two plots did not mature their grain, and only yielded a very small quantity of hay.

So strong was the growth on most of the plots that it was found necessary to feed the crops off with sheep, and in several instances this had to be done a second and even a third time. The result of this was satisfactory in every case.

The attached folding table gives the total yield from all the plots.

An analysis of this table shows that the following were the average yields of the varieties sown in four or more plots :—

Variety.	Average yield. bushels	lb.	Number of trials.
1. Federation	24	23	31
2. Warren	22	4	4
3. Florence...	21	52	13
4. Rymer	20	53	24
5. Bunyip	20	22	25
6. Thew	20	16	27
7. Comeback	20	11	31
8. Whiteloaf	19	22	4
9. Bobs	18	52	30
10. Firbank...	18	51	4
11. Genoa	17	6	11
12. Cleveland	16	54	6
13. John Brown	16	31	9
14. Jonathan	13	44	8
Farmers' Varieties	19	18	34

Although it is hardly fair to draw conclusions from one season's experiments, the following few notes regarding the results obtained from the different varieties will be of interest.

Federation easily takes first place, with an average of 24 bushels 23 lb. in the thirty-one trials. Its superiority was especially demonstrated in the Southern Division, where it averaged 27 bushels 49 lb., as against the next best, Bunyip, with 20 bushels 49 lb. In the Western Division it also came first, with an average yield of 23 bushels 39 lb., Comeback being second with 20 bushels 18 lb. In the Northern Division, it came second with 22 bushels 41 lb. per acre, Florence being first with 23 bushels 28 lb.

View of the Orange Farmers' Plots, showing the fine growth made by the wheat and oats crops.

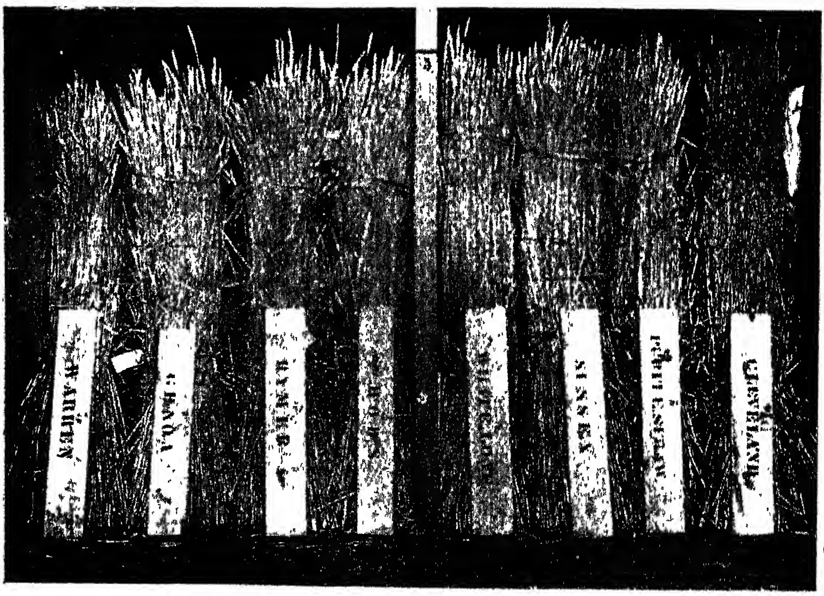
This variety gave record crops of 40 bushels per acre at Albury, without manure, 41 bushels at Germanton with 56 lb. superphosphates per acre, and 44 bushels per acre at Germanton and 40 bushels at Wyalong with 42 lb. superphosphate and 14 lb. of sulphate of potash per acre. These four highest yields were all obtained in the Southern Division.

It took first place at Albury, Germanton, Henty, Berrigan, Deniliquin, Temora, and Wyalong, in the Southern Division; at Maryvale, Eugowra, Parkes, Mungeribar, and Young, in the Western Division; and at Manilla, in the Northern Division.

The following table also shows that Federation proved vastly superior in yield to the Farmers' varieties of the old Purple Straw type:—

	Federation.	Farmers' Varieties.
Southern Division ...	27 bushels 49 lb.	21 bushels 23 lb.
Western ,, ...	23 ,, 39 ,,	18 ,, 47 ,,
Northern ,, ...	22 ,, 41 ,,	18 ,, 12 ,,

Warren.—Although this wheat came second in the averages, it was only tried in four places, and therefore it can hardly be compared with the other varieties, which were tried in a large number of plots. Still, it gave really good results in all of the four trials, though it did not come first in any.



Specimen sheaves of 8 varieties of wheat grown on the Orange Farmers' Plots. Yield, 13 to 28 bushels per acre.

Florence.—Although placed third in the list, it should really be regarded as second only to Federation, as it was tried in a much larger number of plots than Warren. Of the new varieties used in these trials, it proved to be the best yielder, and was very highly spoken of by many farmers who inspected the plots, both as a grain and hay wheat. It proved especially suitable for the Northern Division, where it came first in average yield with 23 bushels 28 lb. per acre. It was first in yield at Narrabri, in the North-West, and at Dapper, in the West.

As a result of its success there was a great demand for seed for this season, but supplies were very limited, and all stocks were sold out early in the season.

Rymer.—This variety was a close fourth, with an average of 20 bushels 53 lb. per acre in twenty-four trials. This appears to be a very reliable cropper, coming first at Quirindi and Mudgee, and giving a good yield at all the places in which it was tried. It appeared to be specially suited to the Western and North-Western districts, where it came third in the average yield.

Bunyip.—Though fifth in the list, Bunyip was described by many of the farmers who grew it to be one of the most promising varieties yet introduced. Its robust growth, medium-length straw, earliness, and heavy yield of fine, full grain, make it a very popular variety both for grain and hay. The demand for seed of this variety was also greatly in excess of the supply, and very heavy prices were paid for it.

It came first at Jerilderie, Gilgandra, Condobolin, Grenfell, and Cumnock.

Thew.—This proved to be a good cropper, especially in the Northern Division, coming first at Wee Waa, Warialda, Curlewis, Tamworth, and Uralla. It also came first at Narromine and Gulgong, in the Western Division.

Complaints were received about its being a weak-strawed variety; and as the flour from it is also classed as weak, this variety is not recommended for the wheat-growing areas.

It proved, however, to be the best variety grown during the past season for producing green fodder and hay in the coastal districts, yielding very heavy crops, and, in consequence of its earliness, escaping rust.

Comeback again gave satisfactory results, coming second to Federation in the average yields in the Western Division, and taking first place at Kelvin and Gunnedah, in the North-West. It appears to be particularly well suited to this latter district.

Both as a hay and grain wheat it is very highly spoken of by farmers.

Whiteloaf was only tried in four districts. It gave fairly satisfactory results, and is certainly worthy of further trial.

Bobs.—During this season this variety did not do as well as expected, but the average returns show that it gave a slightly better yield than the Farmers' varieties, and as it is such a favourite with the millers, I consider that its cultivation should still be encouraged.

Firbank proved to be one of the most promising of the new wheats as a hay producer, but did not come very high in the average yields of grain. It was only tried in four plots, however, and may yet prove to be a suitable grain producer in some districts.

Genoa, another new variety, proved somewhat disappointing in comparison with Florence, but gave satisfactory results in the North-Western districts, and came first at Gunnedah.

Cleveland was only tried in the cooler districts; and as the yields in these districts were generally low, it came low in the average; but it took first place at Queanbeyan and Millthorpe, and may be regarded as one of the best varieties for the cooler wheat-growing districts, both for hay and grain.

John Brown.—Although rather low in the average yields, this variety gave wonderfully good returns in certain districts, coming first in order at Breeza, Rylstone, Blayney, and Armidale.

Jonathan, like Cleveland, was only tried in the cooler districts, and hence its low position in the averages.

Of the varieties tried on a small scale, Sussex, Bayah, Haynes' Blue Stem, and Yandilla King proved very promising. Sussex, in the only two trials made, came top in each. Haynes' Blue Stem was top at Tenterfield, Bayah at Bathurst, and Yandilla King at Wagga. These are being given more extensive trials this season.

Manurial Trials.

It will be seen that seventy manurial trials were made, each trial consisting of three plots, namely: (1.) No manure; (2.) 56 lb. superphosphate per acre, costing 2s. 6d.; (3.) 42 lb. superphosphate and 14 lb. sulphate of potash per acre, costing 3s. 6d.

The average of these seventy plots was as follows:—

	Bushels	lb.
1. No manure	18	53
2. Superphosphate	20	45
3. Superphosphate and potash	21	17

This shows an average gain of nearly 2 bushels of wheat by the use of superphosphate to the value of 2s. 6d. per acre, and of nearly 2½ bushels by the use of superphosphate and potash to the value of 3s. 6d. per acre. The gains by the use of manure ranged to as much as 14 bushels per acre.

Only in a few instances was there any loss occasioned in using the manure, and in several of these the loss was due to the manure being broadcasted, owing to a drill being unprocurable.

The losses which did occur were on one or two of the plots situated on the black soils of the North-West, such as at Delungra, and on rich soils in the west, such as that at Narromine. Even at these places, however, the evidence obtained was somewhat contradictory, and further manurial experiments will be made at these places this season.

Wheat Experiments in the Northern Division.

W. R. FRY, Acting Inspector of Agriculture.

THE wheat experiments initiated in the Northern Division were conducted on sixteen farms, and comprised fifteen grain trials, and one hay trial. Those from the North-West were sown from the middle of April to the end of May, and those in New England during June.

Most of the plots were sown with a seed drill, but where this was unobtainable the cultivator and seeder combined was used, or the seed was broadcasted, and harrowed or ploughed in.

Only one of the plots (Manilla) was sown on fallowed land, and one (Narrabri) on newly cleared land. All the other land under trial in the North-West district has been regularly cropped with wheat for a number of years without manuring.

The rainfall during the growing period was rather too abundant, promoting a rank growth, which was especially favourable for the development of rust.

Two of the Farmers' plots (Breeza and Gunnedah) were fed off by sheep during July, and again during August, and the ultimate grain yield was greater than adjacent crops that were not fed off.

Owing to the excessive rainfall the plots were more or less attacked by rust, but the grain was not materially affected, all samples being saleable.

The detailed yield of each variety can be seen on reference to the completed tabulated report, but the average yield of varieties in the Northern Division were as follow:—

Variety.	Average yield. Bushels	lb.	Number of trials.
Florence	23	28	6
Federation	22	41	11
Rymer	22	23	8
Comeback	20	55	12
Thew	20	53	14
John Brown	20	46	5
Bunyip	20	42	8
Bobs	19	36	9
Genoa	17	20	3
Farmers' Varieties	18	12	10

It will be noticed that eight of the Departmental wheats returned a higher average yield than the Farmers' varieties. In only one instance, namely, at Manilla, did the yield of the Farmers' variety exceed that of the Departmental wheats under trial. The variety used in this case was Steinwedel.

Among the new Departmental varieties, Florence promises to be a most valuable introduction, being particularly rust and bunt resistant. It is an upstanding and early wheat, and appears to be particularly suited to the Narrabri district, where it yielded over 30 bushels per acre.

Rymer and John Brown maintained their reputations as prolific, upstanding, storm-resisting wheats, and appear to be especially suitable for the black soils around Breeza and Quirindi.

Federation gave an average yield of over 22 bushels per acre from eleven plots, yielding up to nearly 32 bushels on several plots. The exceptionally wet season, however, was not suitable for this prolific, drought-resisting variety, some farmers' crops being so badly pinched by rust that millers offered lower prices for the grain.

The average yield of Thew wheat, from fourteen plots, was nearly 21 bushels. At Wee Waa it yielded nearly 36 bushels per acre. It is, however, very weak in straw, and went down badly in places from storms. As

it is also of low flour strength, it cannot be recommended for extensive cultivation in this district.

Comeback gave an average return of nearly 21 bushels per acre from twelve plots in the North-West, yielding up to 33½ bushels at Wee Waa. This wheat is becoming a great favourite in the Narrabri district, yielding either grain of superior quality, or excellent hay. When sown too early, it was liable to damage from frosts, and, where allowed to grow too high, it went down.

Bunyip gave an average yield of nearly 21 bushels per acre, yielding over 34½ bushels per acre at Wee Waa. Owing to the wet season, however, this variety was affected by rust, and being rather a slow grower, was, at first, in some of the plots—especially at Kelvin—considerably checked by black oats and weeds.

Bobs yielded up to 34½ bushels per acre at Warialda, and averaged 19 bushels 36 lb. per acre over nine plots. In the warmer districts, it was noticed that plots sown with Bobs seed supplied from the Glen Innes Experiment Farm were later in maturing than Bobs locally-grown. It was also noticed that much of the so-called local Bobs wheat consisted of a mixture of Jonathan and other varieties. This admixture has affected the reputation of the variety.

In the North-West district, all the plots were harvested with a stripper or harvester drawn by horses or bullocks, but in New England they were cut with a reaper and binder and threshed. Continuous rain whilst the wheat was in stooks considerably affected the results from these plots. It was proved, however, that Haynes' Blue Stem (a Manitoba variety), Jonathan, and John Brown, are prolific and profitable wheats for those localities. The Tenterfield miller is now offering an increased price for these improved varieties over that offered for the White Velvet Pearl variety, which has hitherto been grown there.

The accounts rendered for controlling the farmers' plots in the New England districts also prove that many of the operations are conducted on too small, and, therefore, too expensive a scale, for profitable wheat-farming. By the use of multiple ploughs, wider harrows, and better methods of threshing, and in some cases the application of fertilisers, the New England farmers can profitably produce wheat of the Manitoba and stronger types equal to that from any part of the State.

In the manurial trials, an increased yield was obtained in most cases where the manure was applied with a drill, but where the fertiliser was merely broadcasted, very little difference was recorded. The increase due to manuring (drilled) ranged from 2 bushels up to 5½ bushels per acre at Narrabri, in the North-West, and up to 7 bushels at Uralla, in New England district.

On the north-western slopes and plains there are up to date over 250,000 acres under cultivation, as compared with 220,000 acres last year, there being an increase of 10,000 acres in the Boggabri police district alone. With

the development of Pilliga Scrub there is every indication of a considerable increase of wheat lands in the Narrabri district. As most of this cultivation area is comparatively new, very little fallowing or manuring has yet been practised. This season, however, some wheat-growers have obtained fertiliser drills, and there is no doubt that the results of some of the experiments have encouraged them to do so. It is true that on some of the stronger soils the excessive rains caused some of the manured plots to go down, so that very little increased grain was harvested; and in one case—Delungra—an actual decrease resulted. It is hoped, however, to continue these manurial experiments during a season of less abundant rainfall.

Further definite information on the effect of fertilising strong soils would be very instructive. The experiments proved that on the granitic and sandy soils the application of fertiliser was exceedingly profitable.

Most of the farmers conducting the experiments have offered to continue the plots this season, whilst many additional offers have been received.

It was noted that in some few cases where the operations were left to the farmers, the results were not altogether satisfactory. This appeared to be due to the fact that the practical farmer is accustomed to put in large areas, and to work for a large profitable return, and has not received the necessary training for accurate experiment work. Some farmers' experiments which I inspected, and which were initiated and conducted by the farmers themselves, were utterly useless for comparative information, owing to the neglect of some absolutely important details. To obtain accurate and reliable results, it is necessary for the experiments or districts to be so arranged that the inspectors can certify to or supervise all the operations.

Local farmers, in the majority of cases, exhibited great interest in the experiments, and many inquiries have been received by the experimenters and the Department for seed of those varieties that have proved themselves superior to local varieties. The general opinion expressed is that the Farmers' experiment plots are the most practical educational system yet initiated by the Department of Agriculture, and there is every evidence of the interest being maintained.

Wheat Experiments in the Southern Division.

HUGH ROSS, Inspector of Agriculture.

AREAS of 10 acres were laid out in different districts, and strips of half an acre were sown with varieties of wheat recommended by the Department. These were tested against each other, and also against what the farmer considered to be his best variety. While the object has not been to aim at

records, still some remarkably fine yields were obtained. The following list gives the average yields of the principal varieties used in the experiments:—

Variety.	Average yield. Bushels	lb.	Number of trials.
Federation	27	49	8
Bunyip	20	49	7
Florence	20	46	4
Bobs	20	39	6
Rymer	19	59	5
Thew	18	58	3
Comeback	18	55	8
Farmers' Varieties...	21	23	9

From the foregoing figures it will be seen that Federation easily holds the premier position as a grain wheat in the Southern Division. It yielded the fine average of 27 bushels 49 lb. per acre in eight trials, over 40 bushels being obtained at Albury.

A few comparisons between the best of the Departmental varieties and the best Farmers' variety may prove of interest.

At Albury, the Departmental variety Federation went 40 bushels per acre, while the Farmers' variety, Dart's Imperial, yielded only 25 bushels.

At Germanton and Wyalong the Farmers' varieties, Club Head and Dart's Imperial, yielded 27 bushels 28 lb. and 30 bushels 21 lb. per acre, respectively, while Federation yielded 36 bushels 12 lb. and 35 bushels 59 lb.

An increase of over 11 bushels per acre is noticeable in the field at Deniliquin, for, while Dart's Imperial in that locality yielded only 15½ bushels, Federation yielded over 26½ bushels per acre. In the same plot, half an acre of Bunyip sown on fallowed land resulted in a yield of 17 bushels 40 lb. per acre of clean grain, whereas a similar area of non-fallowed land yielded at the rate of only 12 bushels per acre, and the grain was dirty with wild oats.

It is noteworthy that in not one single instance has the Farmers' variety given as good results as the Department's wheat, and it is indeed a matter for congratulation that our own State should have been able to create varieties of wheat which excel all others not only in regard to yield, but also in milling qualities.

Besides variety trials, manure tests have also been carried out in each field, and these afford some interesting information. Trials were conducted on land unmanured, land manured with 56 lb. superphosphate per acre, and land manured with 42 lb. of superphosphate and 14 lb. of sulphate of potash per acre.

The returns of the manurial trials showed a substantial increase in yield as the result of an application of ½ cwt. of superphosphate per acre; roughly speaking, at a cost of 2s. 6d. per acre. In comparing the yields of the various plots, we find that at Germanton the addition of the manure had the effect of increasing the yield by as much as 14 bushels per acre; at Henty by 8 bushels; at Temora by 6 bushels; and in the eight districts the average increase amounted to 5 bushels per acre.

Whether the addition of 14 lb. of sulphate of potash per acre is a practice which the farmers in the Southern Division should follow, is a question that cannot be answered by the results of one year's experiments. In most cases its application this season has resulted in an increased yield, but on the other hand, in one or two instances, the results have been negative.

In order to encourage farmers in cool districts, where hitherto little wheat has been grown, and also to demonstrate that certain varieties are essentially suited for cool climates, an experiment plot was established in the Queanbeyan district on the farm of Mr. John Reid, Canberra. The results are highly satisfactory, some varieties again showing a marked superiority over others, under identical soil and climatic conditions. The result of this experiment is as follows:—

Number of Plot.	Variety.	Yield. Bushels	lb.
1.	Whiteloaf	14	54
2.	Genoa	20	50
3.	Warren	21	0
4.	Cleveland	23	44
5.	Bobs	22	12
6.	Purple Straw (Farmers' Variety)	21	20
7.	Cleveland (sown with 56 lb. superphosphate) ...	21	20
8.	Cleveland (no manure)	18	0
9.	Cleveland (sown with 42 lb. superphosphate and 14 lb. sulphate of potash)	20	40

The experiments right throughout my district have been watched with keen interest, not only by the experimenters, but by farmers in the various districts. In all cases the work has been carried out by the farmers faithfully and conscientiously.

With the co-operation of practical farmers in establishing demonstration plots in their own districts on their own farms, the man on the land is brought into closer contact with the Department of Agriculture and its officers; and this close relationship cannot fail to leave good effects behind it. By continuing these experiments, and bringing before the farmers' notice from time to time new and more prolific varieties of wheat and cereals, it is confidently expected to effect substantial and lasting improvement in the wheat yield of this State.

Wheat Experiments in the Western Division.

MARK REYNOLDS, Inspector of Agriculture.

The experiment plots in the Western Division numbered eighteen, and embraced the Central Tablelands and the Western Plains. Half-acre, acre, and 2-acre plots, depending upon the size of the paddocks available, were sown with varieties recommended by the Department. They were tested

against each other and against the local variety selected by the farmers. In addition, manurial experiments were carried out at sixteen of the plots.

The season proved a good one, and the majority of the yields were highly satisfactory, although some, through various causes, did not come up to expectations.

Federation, grown in twelve plots, gave the highest average yield, namely, 23 bushels 39 lb. per acre, while at Grenfell it yielded 33 bushels per acre. This variety has proved very suitable for the drier districts as a grain-producing wheat, owing to the fact that it will fill the ears at the expense of the straw; but should the season prove very dry, difficulty may be experienced in harvesting it, owing to the shortness of the straw.

Comeback returned the second highest average yield, namely, 20 bushels 18 lb. per acre, from eleven plots, the highest return of this variety being 33 bushels.

Florence, 20 bushels 8 lb., Rymer, 20 bushels 11 lb., Thew, 19 bushels 48 lb., and Bunyip, 19 bushels 46 lb., all yielded a better average than the selected farmers' varieties.

The wheats in the order of their average yield are given in the following table:—

Variety.	Average yield. Bushels	lb.	Number of trials.
Federation	23	39	12
Comeback	20	18	11
Rymer	20	11	11
Florence	20	8	3
Thew	19	48	10
Bunyip	19	46	10
Bobs	17	44	15
Genoa	16	28	7
Cleveland	15	33	5
John Brown	11	12	4
Jonathan	9	45	4
Farmers' Varieties	18	47	15

Sowing commenced in the beginning of April, but was not completed till 8th July. Delays were caused at various plots owing to endeavours being made to free the land from wild oats. The late sowings caused the yields to be smaller than would otherwise have been the case. At Condobolin, for example, the Departmental varieties returned only from 7½ to 12 bushels per acre, while the Farmers' variety was too poor to strip.

A number of the plots had been previously cropped continuously, with the result that the yields were badly affected. This was particularly noticeable at Millthorpe.

In some cases, owing to the late frosts, the wheats were badly frosted and the yield reduced. This was very evident at Blayney, where the highest return was only 14 bushels 48 lb.

At Gilgandra, owing to the low situation of the plot and the wet season, rust was induced; the highest return being under 16 bushels.

The early-sown crops, especially those on new and fallowed land, returned excellent results. At Parkes, yields of from 21½ to 28 bushels per acre were secured, while at Eugowra and Grenfell the yields ranged from 19 bushels 40 lb. to 30 bushels 10 lb., and from 20 bushels 36 lb. to 33 bushels 58 lb. respectively.

The climatic conditions over the whole area covered by the plots vary considerably. About six of them were situated in dry, hot districts, seven in medium dry and hot, and the remaining five in cooler districts.

The Farmers' varieties were generally selected from the Purple Straw class, but in only one instance did the yield exceed that of the Departmental varieties tested against it.

In the manurial experiments it will be noticed that the application of 56 lb. of superphosphate per acre produced in a number of cases an increased yield, varying from 2 bushels to 14 bushels per acre. In some instances the increases were not very marked, while on certain plots, principally at Narromine and Gilgandra, the return from the manured plot was considerably lower.

The application of 42 lb. of superphosphate and 14 lb. sulphate of potash gave in some cases a higher return than either the unmanured plot or the plot manured with 56 lb. superphosphate, but in a number of the trials the returns were approximately the same, and in some, even lower.

It is impossible, as yet, owing to the difference in soil and climate, to draw definite conclusions from the first year's experiments; but the figures will provide valuable data, and will be useful in conjunction with those of subsequent years, to enable deductions to be made.

Summary.

1. For yield of grain, Federation stands easily first.
2. There is little difference in yield between Florence, Rymer, Comeback, Bunyip, and Thew, and all of these can be strongly recommended for cultivation on a large scale, with the exception of Thew wheat, which, on account of its weak straw and flour, is not recommended for the grain-growing districts.
3. In selecting from the above, attention should be given to the recommendations of the Wheat Conference, published in the *Agricultural Gazette* of February and March, 1910.
4. All the above varieties are superior in yield to the wheats previously grown in this State.
5. The use of superphosphate is decidedly profitable on almost all soils in the wheat-growing areas, only a very few plots showing negative results.
6. The addition of a small quantity of sulphate of potash to the superphosphate often gives satisfactory results; this is especially the case on soils that have been long under cultivation.

As the crops grew, interest in these experiments rapidly extended; and when it was seen that such good yields would be obtained from some of the newer varieties, a great demand set in for the seed. As a result, the Experiment Farms were quite unable to supply anything like the quantities asked for, and farmers had to be content with small quantities with which to grow seed for future use.

There can be no question that the farmers' plots have done a great deal towards bringing the "man on the land" into closer touch with the Department, and that the benefits of this work will be greatly extended in the future. They have also been very effective in inducing farmers to take greater interest in, and to grow the better varieties of wheat, thus doing much towards improving the quality of the wheat the State is exporting.

When this work of wheat improvement was commenced by the Department, in conjunction with the late Mr. Farrer, it was stated by the leading experts that if a variety could be produced which would yield from half a bushel to 1 bushel per acre in excess of the yield of the wheats then grown, and at the same time could be improved in regard to quality, especially flour strength, it would more than repay the entire cost of the Department of Agriculture. From the results of these experiments, it seems that more than this has been accomplished, for in Federation we have a wheat which will not only give a bushel more than the old varieties of wheats, but in these trials, which were conducted over all the principal wheat-growing areas of the State, it gave, as already stated, an increase of over 5 bushels per acre.

Besides this, the Department can claim that it has now distributed, on a large scale, at least six Farrer wheats which are superior in yield to the wheats hitherto grown here, and of far better quality as flour producers.

Winter Fodders for the South Coast.

R. N. MAKIN, Acting Inspector of Agriculture.

WITH the object of ascertaining the most suitable varieties of wheat, barley, oats, and rye for fodder for the South Coast district, a commencement was made with a series of variety trials at the following six different centres, viz., Berry, Dapto, Milton, Unanderra, Moruya, and Kangaroo Valley.

The season generally was unsatisfactory for heavy yields, as well as for trials as to rust-resistance, being very dry. Still some good yields were secured, notably those at Kangaroo Valley; and from all the plots valuable information regarding the behaviour of the varieties was obtained.

Wheat.

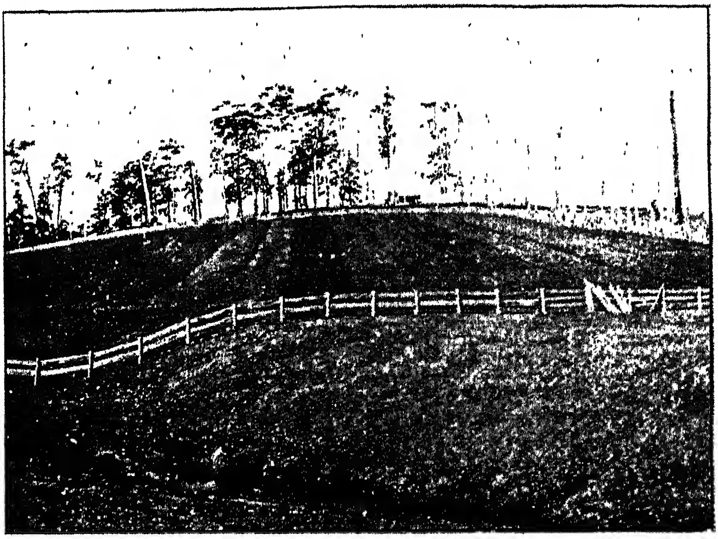
The varieties of wheat selected for trial were Bobs, John Brown, Thew, Uppercut, Warren, and Whiteloaf. Only two of the six varieties showed any signs of rust, viz., Uppercut and Whiteloaf. The wheats were cut for

fodder, and from the results obtained the following information has been gathered:—

Thew proved to be by far the best variety, giving the heaviest yield and maturing earliest, and the fodder being of excellent quality. The record crop was obtained with this variety at Kangaroo Valley, viz., 10 tons 14 cwt. green forage per acre.

John Brown came second in point of yield, but proved weak in straw.

Uppercut and *Warren* also gave good results, the former yielding 8 tons 1 cwt. of fodder at Kangaroo Valley, and the latter coming at the top at Milton with 5 tons 11 cwt.



View of cereal plots at Milton, showing the arrangement of long, narrow plots, with dividing strips between.

In some instances good crops of grain were obtained on the coast this season. Mr. Arthur Ewin, of "The Chase," Milton, was supplied with seed of Thew and Whiteloaf, and he reports as follows:—

Thew wheat grew first-rate from the start, with a nice clean straw and not a sign of rust, and turned out just on 40 bushels per acre. It grew to a height of about 5 feet. I should think this wheat would suit this district very well. It was grown without manure, but the land was well cultivated before planting.

Whiteloaf did not do nearly so well. It did not stool out so well as Thew, and only turned out about 19½ bushels per acre, though planted under the same conditions and in the same land. The land was not first quality land. I am preparing 6 acres to experiment with this year.

The following report was received from the Principal, Hawkesbury Agricultural College, on Thew wheat:—

Thew.—A very early wheat, with a fine soft straw. It resists drought well, and is usually free from rust. It is one of the best hay wheats for this district, especially in dry seasons. This variety can be sown at any time during the season.

The wheats recommended for trial on the South Coast are:—

Thew.	Huguenot.
Uppercut.	John Brown.
Medeah.	Warren.

These are being sown in the plots this season.

Oats.

The varieties tried were Cape, Algerian, Silvermine, Twentieth Century, Goldfinder, Potato, Improved American, Great Northern, and White Hopetown.

Plot of John Brown Wheat at Berry Stud Farm.

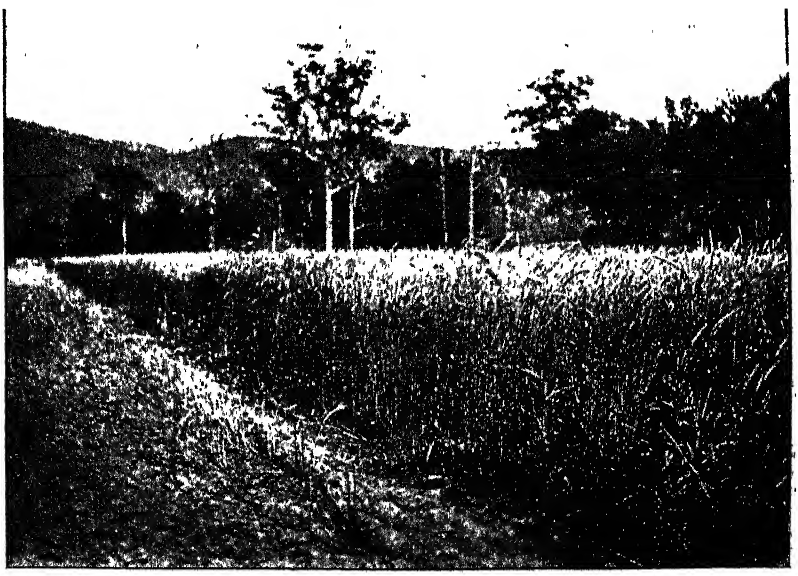
During the early stage of the crops' growth several of the varieties appeared to be much superior to Algerian, but when the crops matured, and were weighed, it was found that Algerian gave by far the heaviest yield; this variety also proved generally to yield the best quality fodder, in consequence of its being free from rust, whereas the other varieties were rusty in almost every instance.

The record crop was obtained from Twentieth Century at Kangaroo Valley, with 13 tons 12 cwt. of green forage per acre.

The Cape variety proved to be the earliest tried, and is evidently a very suitable oat for early fodder. Improved American is also worthy of further experiments, as it is early, and yields a large quantity of good quality green fodder.

One object of this experiment was to find a variety or varieties superior to Algerian, but in this the experiment failed, for when the results were received it was found that Algerian had proved to be undoubtedly the best oat for cultivation on the Coast. It is intended to continue these experiments by trying other varieties; and every effort will be made to secure better varieties either by breeding or by importation.

Plot of Skinless Barley at Kangaroo Valley showing the dense growth.
Yield, 10 tons 16 cwt. of green forage per acre.



Plot of Thew Wheat at Kangaroo Valley which yielded 10 tons 14 cwt. of green forage per acre.

Barleys.

Trials of Skinless and Cape barleys, as well as barley *v.* barley and tares mixed, were made. The results showed that there was little difference in yield of green fodder between the two barleys, but generally Skinless was the better quality fodder. Barley and tares gave slightly heavier yields than barley alone; and considering the higher feeding value of the mixed fodder this is further evidence of the advisability of sowing the barley and tares in preference to the cereal alone.

The yields of barley varied remarkably. Both Cape and Skinless failed completely at Berry, and yet sown at the same time and under similar conditions at Kangaroo Valley—not 14 miles away—splendid crops were obtained, Skinless yielding 10 tons 16 cwt., and Cape 10 tons, of green forage per acre.

This remarkable variation in growth is due, of course, to a great extent to the rainfall; but much of it is also due to the difference in the soils. It is evident that the cold, heavy, and somewhat sour flats at Berry are unsuitable for barley, whereas the warmer and lighter soils at Kangaroo Valley suit this crop well.

Rye.

Only one variety was sown, viz., Emerald. The yield in most cases was not satisfactory, the only good crop being one of 10 tons of green forage per acre at Kangaroo Valley. During the present season four varieties of rye are being tried.

"The Smuts of Australia."

By D. McALPINE, Vegetable Pathologist, Department of Agriculture, Victoria.

In the first part of this recent work, Mr. McAlpine deals very thoroughly with the general character of smuts and bunts. This is followed by an account of the modes of infection and the life history of each of the species which attack wheat, oats, barley, maize, sorghum, and various grasses, the whole forming a very interesting and valuable series. This section leads naturally to that dealing with field experiments carried out with a view to controlling the attacks of these insidious foes of the farmer. It is of interest to note that Mr. McAlpine has experimentally confirmed the fact that treatment of the seed with bluestone is a very much more effective means of controlling many of the smuts than formalin treatment. The book is brought to a conclusion with a scientific description of all the *Ustilagineæ* known to occur in Australia.

The whole work is well illustrated by photomicrographs and photos. It forms a worthy companion to the author's previous work on "The Rusts of Australia," both being contributions of great value to farmers and to scientific workers in mycology and plant pathology.

Manchurian Millets

THE year before last, Mr. C. F. Jeanerett supplied the Department of Agriculture with small trial packets of the Manchurian varieties of millet, Hsiao-mi (white) and Hsiao-mi (yellow). These were sent to the Grafton Experiment Farm, where they have proved two of the finest millets yet introduced. The manager of the farm, Mr. A. H. Haywood, has furnished the following report:—

GRAFTON EXPERIMENT FARM.

REPORT of trial of two varieties of Manchurian millet, Hsiao-mi (white) and Hsiao-mi (yellow):—

The seed sown was saved from a trial plot of these millets grown last year.

One-twelfth of an acre of each variety was sown in drills 2 feet 6 inches apart, and during growth was cultivated with a one-horse Planet Junior.

The plot of ground chosen had previously been cropped with lucerne for several years, and the soil was basaltic (chocolate).

Both varieties gave about equal bulk of green fodder, estimated at 10 tons per acre.

The Hsiao-mi (white) averaged 4 feet 6 inches in height. The yellow variety did not grow so tall as the white (about 4 feet), and was not equal to it for fodder purposes, but it yielded more seed per acre.

Both varieties were fit to cut for greenstuff in ten weeks from date of planting, and both appear to be extremely hardy, withstanding dry weather exceptionally well. When at the seeding stage they stand up well, and do not easily shell out. They also stand wet weather well when matured.

Fig. 1.—
Manchurian Millet at Grafton Experiment Farm.

Fig. 2.—Manchurian Millet (Hsiao-mi, White), Grafton Experiment Farm.

Fig. 3.—Manchurian Millet (Hsiao-mi, Yellow), Grafton Experiment Farm.

Both varieties proved to be far superior to the Hungarian millet sown at the same time, either for seed or fodder, and gave three times the bulk of greenstuff in this trial.

Either of these millets should be valuable for catch crops. They are the heaviest seeding millets that I have seen, and I consider them especially valuable for poultry feed, bird seed, and as a green fodder and catch crop.

Name of Variety.	When sown.	Quantity sown per acre.	Area sown.	When harvested for Seed.	Yield of Green Fodder.	Yield of Seed.	Estimated yield of Seed per acre.	Time matured Seed.
	1909.		acre.		tons.	lb.	bus. lb.	days.
Hsiao-mi (white)	29 Oct.	4 lb. (about)	1/12	14 Feb.	10	245	49 0	108
Hsiao-mi (yellow)	29 Oct.	,,	1/12	,,	10	264	52 48	108

Drilled in rows 2 feet 6 inches apart.

In the early stages of growth dry weather prevailed, and from the 18th November excessive rains fell, the records being as follow:—

	Points.
November	386
December	648
January	443
February (to 14th)	405
	1,882

INDEX TO THE *Agricultural Gazette*, 1890 TO 1909.

THOSE of our readers who are in possession of a complete, or partially complete, set of the *Agricultural Gazette* will be pleased to know that a comprehensive Subject and Author Index to the twenty volumes issued up to and including 1909 has been prepared by Mr. H. C. L. Anderson, M.A., Under Secretary, Department of Agriculture, and is now in the press. The Index has been compiled on the same principles as are adopted in preparing the Indexes in the Public Library of New South Wales, and it makes a book of 117 pages royal 8vo.

The wearying process of wading through the twenty annual Indexes already issued to find information on a particular subject is now obviated. Farmers, and particularly agricultural and scientific bodies in this and other States and countries, who possess large or complete sets, will appreciate the work.

The book will be published by the Government Printer, Sydney; price bound in strawboards, 5s. per copy.

Federation Wheat, from Farmers and Millers' Point of View.

H. ROSS, Inspector of Agriculture.

The large increase in the yield of wheat recently obtained, not only in this but also in neighbouring States, is in no small measure due to the introduction of varieties of wheat more suited to climatic conditions in hot, dry districts, than those under cultivation a few years ago. Foremost among those varieties stands Federation, a variety too well known by most wheat-growers to need any further description. It is sufficient to say that on account of its yielding qualities, ease of stripping, stiffness of straw and consequent resistance to wind and storms, there is no variety of wheat that has found so much favour in the eyes of farmers as Federation. It would be difficult to exactly judge the increase in yield due to the cultivation of this variety, but some idea may be formed by quoting some of the yields obtained in the Farmers' Experiment Plots, 1909-1910, in the Southern district with Federation, and comparing them with the yields obtained from the varieties which the farmer considered to be the best for his soil and climatic conditions.

Name of Experimenter.	Locality.	Yield per acre.		
		Federation.	Farmer's own wheat.	
		bus. lb		bus. lb.
S. P. Wilson	Jerilderie ..	26 44	Plover .. .	19 32
M. J. Carew ...	Deniliquin ...	24 20	Dart's Imperial	15 30
A. Hulme	Germanton ..	41 14	Club Head ...	27 41
G. Laidlaw	Albury	40 4	Dart's Imperial	25 15
R. Gagie	Wyalong ..	39 35	Dart's Imperial	30 46

The above figures speak for themselves, so that little comment is needed; wherever Federation has been introduced it has, after the first trial, been received enthusiastically, and the large demand for wheat land at the present time is in no small degree due to the large yields obtained in late years, mostly from areas sown with Federation wheat.

Yet there are to be found some people who, no matter how good an article may be, will endeavour to find fault somewhere, and so it has been with Australia's premier yielding wheat. From time to time farmers have mentioned to me that persistent rumours had reached them to the effect that millers do not regard Federation as a good milling wheat, and that there was a possibility of not receiving top price for this variety on that account.

In order to set the matter at rest, I have obtained opinions regarding the milling qualities, from a commercial point of view, of three of the leading millers in the Riverina. I have asked them to state exactly and precisely

their unreserved opinion regarding this wheat, and to point out how this variety compares with varieties of the older types, such as Dart's Imperial, Purple Straw, Red Straw, Farmer's Friend, &c. I will name the millers Nos. 1, 2, and 3 respectively, and quote their own words.

Miller No. 1 said:—

Ever since Federation has been grown to any extent in the Riverina our firm, after having carried out exhaustive practical milling tests, have sought after this wheat more than other varieties. Our manager and miller think so highly of Federation as a milling wheat that we are inclined to give 1d. per bushel more for Federation and 1d. per bushel less for Dart's Imperial. The quantity of flour milled from Federation is about the same as that milled from the older varieties; the colour is good, and strength better. We carry on an extensive business both in Riverina and Sydney, and consider that the excellent standard of our flour is largely due to the increased proportion of Federation milled. Not only are we prepared to buy as much Federation as we are being offered, at market price, but, as stated before, we are inclined to give a little less for some of the older varieties.

Miller No. 2 expressed himself as follows:—

We have used Federation wheat extensively now for a number of years. Like other millers, we mix a number of varieties together. I can emphatically say that Federation has upheld its reputation as a good milling wheat, and nothing is further from our mind than to offer less for this variety than any other. Regarding the colour of the flour, we find it excellent; for our own and the farmers' sake we trust that Federation will continue to hold the position of first favourite with wheat-growers. We have had no complaints at any time regarding the colour of our flour, which, however, as mentioned before, we never mill by itself. We would sooner mill Federation than Dart's Imperial.

Miller No. 3 said:—

A large percentage of Federation finds its way to our mill; especially has this been the case last season. While we are not inclined to give a higher price for Federation wheat, we certainly do not offer less for this variety. It must be admitted that the colour of the flour is not quite as white as that milled from some of the other varieties, but commercially it does not affect us. Regarding the bran and pollard, we have no fault to find. It is certain that the increase in yield from Federation appears to be considerable.

Here, then, we have the opinions of three leading millers in the Riverina district. None of them express any intention of giving a less price for Federation than other varieties; on the contrary, at least one of the three is inclined to give less for some of the older varieties if Federation can be obtained. This should be sufficient to refute any statements made which are calculated to detract from the merits of this sterling variety of wheat. It may be mentioned that any variety of wheat recommended by the Department of Agriculture has first to satisfy the experts both as to its yielding and milling qualities. A standard is set in regard to colour of flour, strength, gluten percentage, ease of milling, &c., and any variety not coming up to that standard is rigorously rejected.

Federation has at all times fulfilled every expectation, both in reference to milling qualities and yielding capacity, and farmers may rest assured that no variety will have the Department's recommendation unless it withstands the somewhat strict tests applied.

The following extract from the Melbourne *Argus* of the 3rd May, 1910, will show that the opinion of Messrs. Noske Bros., leading millers in the

Wimmera district, which is the principal wheat-growing area in Victoria, confirms that of the New South Wales millers quoted above:—

Federation Wheat: its Milling qualities.

HORSHAM, Friday.—Considerable apprehension was caused in the wheat-growing areas of the Wimmera by the circulation of a report containing the alleged discovery that Federation wheat is very poor in milling qualities. Considering the fact that this variety is grown so extensively on the Wimmera, the opinion of Mr. Oliver, head miller for Messrs. Noske Brothers, at Horsham, was sought. Mr. Oliver said:—" Our opinion is that Federation is every bit as good as the other wheats. We find no great difference in the returns that we get from the Federation wheat and the others, such as Dart's Imperial, Purple Straw, and those which are considered to be the best wheats. As far as strength goes it is tip-top. In fact, we would be quite pleased if the whole of the Victorian farmers grew it. It is slightly harder, and requires a little more power to reduce it; but, when the returns are taken into consideration, that is nothing."

In conclusion, I make an earnest appeal to farmers to not only persevere with the cultivation of Federation, but to give all of what are known as "Farrer's wheats" a thorough trial.

Mr. G. M. McKeown, manager of the Wagga Experiment Farm, has furnished the appended notes, showing the yield of this wheat over a period of eight years:—

Federation Wheat.

Federation wheat was first grown at the Wagga Farm as a field crop in 1902.

It has not in all seasons proved the heaviest yielder of the varieties grown, but its average for the eight years during which it has been used is 22 lb. per acre in advance of that of any other variety grown for an equal length of time. Last season the yield from 50 acres, sown the full width of a paddock 45 chains wide, was 26¼ bushels, the variety next in order being Zealand, with 23½ bushels from 35 acres. Rainfall 1st May to 15th November, 1,144 points.

The average rainfalls for the growing periods (1st May to middle of November) first referred to were respectively 1,088 points and 1,176 points.

The varieties which have most nearly approached Federation in yield were Farmer's Friend and Hudson's Early Purple Straw, which were rejected on account of their lack of flour strength. The average yields of the latter kinds for an eight years' period were exactly alike.

The seasons of more moderate rainfall have proved the most suitable to Federation, as in 1906, when we recorded 2,668 points for the year, and 1,583 points for the growing months, the yield was the lowest on the Farm.

Judging from reports and the demand for seed, it is the most successful and popular variety in this district.

Experiment with Red Oil and Kerosene Emulsions against Woolly Aphis.

W. B. GURNEY, Assistant Government Entomologist.

LAST year, 1909, I used a "Red Oil" (Vacuum Oil Company's) and kerosene against Woolly Aphis on some small apple trees at Mr. F. R. Archbold's orchard at Narara.

Red Oil Emulsion.

Formula used:—1 gallon oil, ½ lb. soap, 10 gallons water; but we found that 1 of oil to about 30 of water would probably have answered.

The spray was applied to six small trees, on 31st July, 1909. A fine-nozzled knapsack sprayer was used, and the trees were carefully sprayed from all angles, which used about half a gallon of spray to each tree. Where wetted, the Woolly Aphis were destroyed; but on subsequent examination of the drenched trees, it was found that small groups of aphis had escaped in sheltered places, alive and unwetted. The trees, however, were practically cleaned of aphis for the time being, as compared with adjacent unsprayed check trees.

The Red Oil adhered well, and remained as a gradually-decreasing oiliness to be seen on the trees for four weeks after spraying. The trees were not burnt by the spray, but appeared to be a few days later in shooting than the unsprayed trees. A weaker emulsion, as suggested above, can be recommended.

Kerosene Emulsion.

Two weeks later—14th August, 1909—I sprayed two small apple trees adjacent to the others, applying in the same way kerosene emulsion (1 in 10). This appeared to be almost as effective as the Red Oil (1 in 10) in destroying the Woolly Aphis where it touched them.

A kerosene emulsion, 1 in 20, was also used on one apple tree; but in this case a large percentage of the aphis was not killed.

The kerosene emulsions evaporated, or were absorbed quickly, and had disappeared a day after the application.

Notes.

The experiments, as far as they went, showed that Red Oil and kerosene emulsions had much the same effect when used at the strength of 1 in 10; that kerosene emulsion, 1 in 20, was too weak for best results; but that probably Red Oil at 1 in 30, or 1 in 40, would have been effective. Red Oil Emulsion remains and spreads long after kerosene emulsion has disappeared.

The experiments show further that even on small, clean-limbed trees a percentage of the Woolly Aphis may escape even careful spraying; but it seems probable that if sprayed more than once thoroughly in July and August each year, the Woolly Aphis might be kept in check.

This year—1910—the trees are apparently as badly infested again, and are to be resprayed during July and August,

The price of kerosene is 9½d. per gallon, and Red Oil is quoted at 2s. 1d. per gallon for 4 gallon lots. The cost of using Red Oil at the rate of 1 in 30 or 40 is therefore less than that of kerosene, 1 in 10. This year the effects of using Red Oil at the rate of 1 in 30 up to 1 in 50 will be tested.

Journal of the New Zealand Department of Agriculture.

We note with pleasure that the Dominion Government has inaugurated the regular publication of an agricultural journal as the medium for disseminating results of investigations and expert advice to farmers. Hitherto official agricultural information in New Zealand has been distributed by means of leaflets and bulletins; but the newly-formed "Department of Agriculture, Commerce, and Tourists" is impressed, as are the Australian State Departments, with the fact that a regular course of official literature, which comes to be looked for on due date, brings about a much closer union between the Department and the farmer than can be achieved by spasmodic publications on special subjects alone.

The great group of primary industries which are now generally embraced by the term "agriculture," are placed in a different position to manufacturing and secondary industries. There is very little danger from local competition, and a farmer's enemies are not his neighbours, but the native or introduced foes of his plants or animals; as well as the drought, the flood, and the bush-fire. The neighbour across the creek is a welcome addition; his presence helps to improve social conditions; his success means more produce from the district, and perhaps a railway; his experience, collaborated with one's own, often points the way to the solution of distressing problems.

As with individuals, so it is with the young nations which are building up the British Empire in the southern seas. The presence of New Zealand butter on the London market has not lowered the price of ours; on the contrary, we have learnt much from the methods adopted in the Dominion, and have gradually so improved our dairy produce as to bring it to the same marketable condition, and hence to receive the same remuneration. New Zealand's advancement will spell good for the Commonwealth in many ways.

The *Gazette,* therefore, gladly welcomes the *Journal* into the field of agricultural literature, with the hope that farmers in the Dominion may derive much benefit from the information published in this form.

Notes on a Fungus found Destroying Potatoes

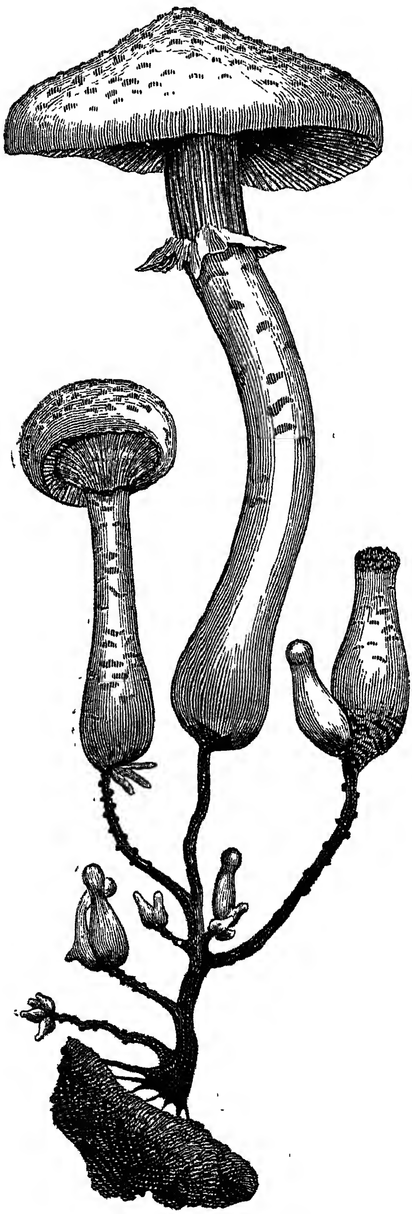
T. HARVEY JOHNSTON, M.A., B.Sc., Bureau of Microbiology, Sydney.

SOME potato tubers, forwarded to the Bureau some little time ago from the Tenterfield district, were seen to be infected by a fungus disease not previously recorded as attacking potatoes in Australia. The appearance of the attacked tubers is shown very well in the accompanying plate. In the two upper figures it will be noticed the potatoes are more or less enveloped by cord-like strands. These chocolate-coloured branching structures are of a rounded or somewhat flattened form. and since they look rather like roots they are termed rhizomorphs. These rhizomorphs are whitish inside, and on being teased up and examined under the microscope, are seen to be composed of a dense mass of fungus tissue (*mycelium*). While the fungus is making its way through the soil it retains the cord-like habit, but on reaching a suitable host, penetrates it at any point, and then gives off delicate branches which pass into its prey. These branches form white sheets of mycelium, which in the case of the potato, readily invade the tissues. As they live at its expense, the latter dies; and, consequently, on cutting such a tuber, one sees a brown dead area pervaded by the white masses of fungus. Ultimately the whole potato becomes destroyed and shrivels into a dry mass reminding one to some degree of the condition known as "dry rot," produced by another fungus, *Fusarium solani*. The two conditions are, however, quite distinct, and are readily distinguishable from each other. In the central figure, the white mycelium may be seen just penetrating into the tuber, whilst in the two lower figures the progress of the disease and the characteristic appearance of a cut surface of a diseased tuber are well shown. In the lower left-hand figure the destruction has been completed.

Many of the tubers examined appeared to be unaffected, even though enveloped by the rhizomorphs, but it could be only a matter of time before these would be invaded.

From the rhizomorphs there may be developed the mushroom or spore bearing stage of this fungus, which is known scientifically as *Armillaria mellea*, Vahl. It is edible, and is sometimes popularly called the "honey fungus." Mushrooms and their allies, the bracket fungi, are the fruiting stages of fungi whose mycelium lives in the ground or in timber. Many are the cause of rotting of timber, *Armillaria* being one of them, whilst others live on decaying organic matter.

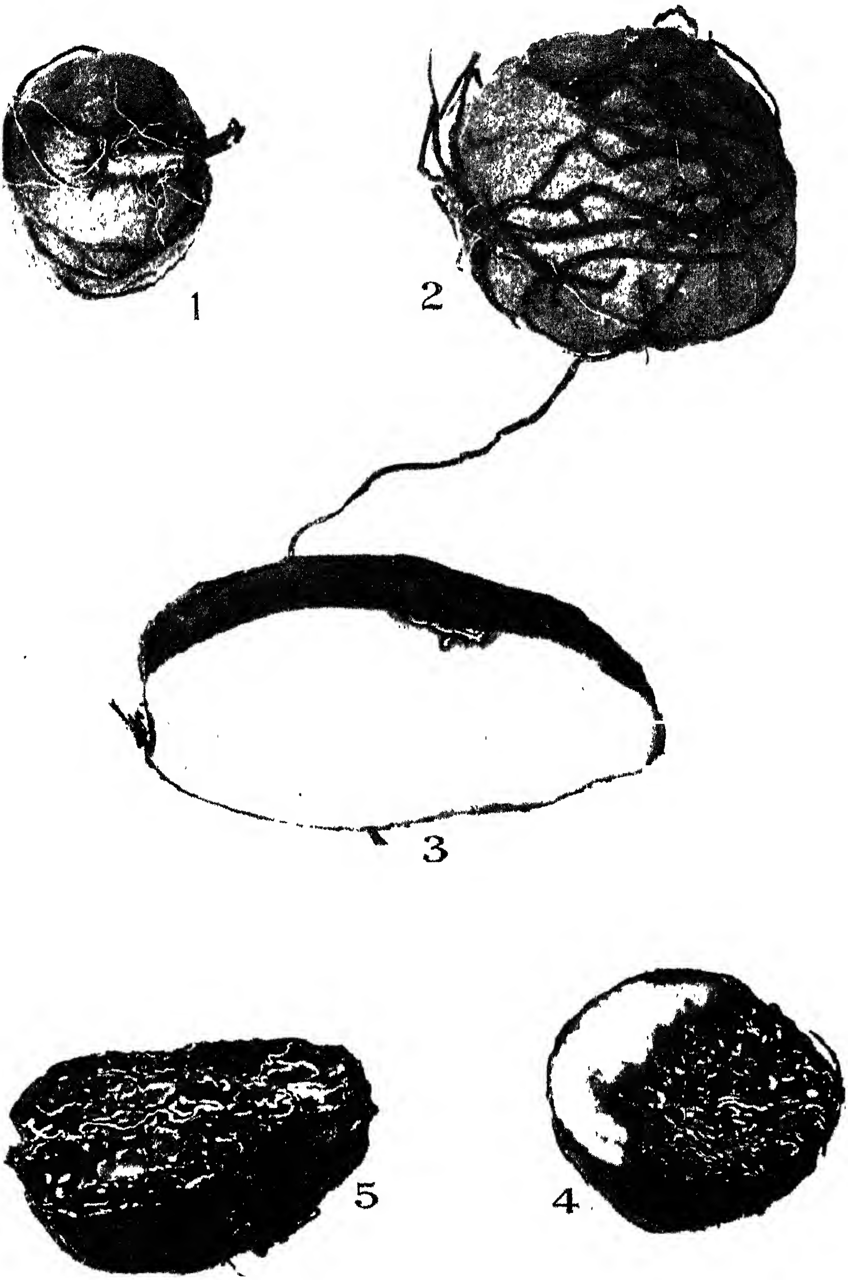
A typical mushroom consists of a stem and a cap or *pileus*, on the under surface of which the "gills" are developed. These gills produce spores in immense numbers. In young specimens, the edge of the cap is connected with the stem by a thin membrane which thus conceals the gills. Owing



Armillaria mellea, Vahl.
From *Agricultural Gazette of N.S.W.*, 1897.

to the growth of the cap the membrane becomes torn away from the rim, and its broken remnants are to be seen adhering to the upper part of the stem. In the case of *Armillaria mellea*, the pileus is from 2 to 6 inches across, and is similar in form to that of the common mushroom, as will be seen from the accompanying diagram. The upper surface of the cap is of a yellowish or honey colour (hence the name of the fungus), while the gills are at first whitish but later brownish. On the cap there occur a number of small dark scales. The spores are white, and are produced on the gills in such abundance as to often give a whitish appearance to them. These spores are readily dispersed and reach the soil.

This fungus has been found attacking the roots of orange, lemon, and apple trees in this State; apricot trees in Victoria; and rose, loquat, and orange trees in West Australia. It appears to be able to attack the underground portions of any orchard tree as well as of forest trees. It is a well-known destroyer of living trees as well as of timber in Europe. Hence this fungus is very dangerous, as it can live not only as a parasite but also as a saprophyte, that is, it can live on dead plant tissues as well. In the case of timber the rhizomorphs in the soil and around the roots send off delicate branches which penetrate the roots and form fine white sheets of fungous tissue which spread between the wood and the bark. Since they are thus attacking the tree in its most vital part, the tree dies. Around the base of the attacked tree or stump there may be seen a cluster of the mushrooms representing the spore-producing organs of this



Potato Tubers showing effects due to invasion by the fungus *Armillaria mellea.*

1 and 2. Tubers surrounded by rhizomorphs of the fungus.
3. Tuber showing beginning of infection. (Germ as white area on one edge.)
4. Tuber partially destroyed by fungus. 5. Destruction completed.

fungus. In the case of the potatoes above referred to, the mushroom stage was seen by the owner of the farm growing amongst the plants, but at the time of my visit it was not observed, as the specimens had been removed earlier.

It should be mentioned that the spores give rise to rhizomorphs which ramify through the soil until they meet with some underground plant-tissue, *e.g.*, a root, which they envelop and attack, and from this point they send out fresh strands. It follows that in attempting to get rid of this pest, it is not only necessary to collect and destroy it in its mushroom stage to prevent spores from infecting the soil, but also to restrict its sphere of underground action. It is the latter which is difficult. Hartig suggested that the infected trees or plants should be isolated by digging a narrow trench around them, the intention being to prevent rhizomorphs from spreading to other trees.

The disease has been gradually spreading in the affected district for several years.

Average Rainfall Map of New South Wales.

Under the direction of the Commonwealth Meteorologist, a map has recently been prepared showing the Mean Annual Rainfall at each station throughout the State where records covering at least fifteen years are available. The map is shaded with darkening tints of blue as the mean precipitation increases, and Isohyets, represented by blue lines, are shown passing through districts having equal rainfalls. Enlargements give in greater detail the information respecting the Catchment Areas of the Sydney Water Supply and Barren Jack Dam. All figures are revised up to the end of 1908.

A copy of this map may be obtained from "The Divisional Officer, Weather Bureau, Sydney," for 1s. It should be of value to all engaged or proposing to engage in pastoral or agricultural pursuits, as the rainfall for any portion of the State can be ascertained at a glance.

Sulphur for American Blight.

Mr. E. Scifleet, of Mudgee, had some apple trees affected with American Blight (woolly aphis). He bored the trees with an inch auger, in a direction slanting downwards, until the point of the auger appeared on the other side. He then filled the hole with sulphur and closed it with an ordinary cork. He states that he has not been troubled with American Blight since.

Many growers have reported good results from similar treatment, whilst others state that they saw no beneficial results. The Department would be glad if all growers who have tested the sulphur treatment for woolly aphis would kindly state results obtained by them.

Australian Dry Farming—A New System of Soil Culture.

R W. PEACOCK, Manager, Experiment Farm, Bathurst.

[The following is the text of the paper read by Mr. Peacock at the Brisbane meeting of the Australian Association for the Advancement of Science last year.]

Introduction.

AUSTRALIAN agriculture has yet to be written. Methods evolved under European and American conditions are not applicable without, in many instances, substantial modification. A new field is opened up for agricultural research. Many of the agricultural writers in Australia to-day are attempting to fit the practices of other lands to Australian conditions, instead of studying those conditions and evolving something more suitable. It is difficult to break away from old and generally accepted theories; those who attempt to do so must be prepared to submit to considerable criticism; the writer expects his full share. The principles which are here elucidated as underlying this system of soil culture can be fully substantiated by perfectly sound physical laws. The main difference between this and other systems lies in the interpretation of those laws and their application. They are, perhaps, opposed to many accepted theories and some writings of the leaders of agricultural thought in Australia. There is, in many cases, a wide gulf between the theoretical writer and the practical Australian agriculturist, the reason being that some of his advice cannot be successfully put into practice. In Australia there is much unwritten agricultural law which is held firmly by the practical man, but he is unable to explain his reasons.

Few men have gone deeply into soil physics conjointly with farm practice. Australian agriculture is demanding that the scientist should be brought more in touch with the practical man in the field, and that he should forsake the city and include the field in his laboratory. Until such is brought about the practical man will not accept his teachings in the spirit in which they are tendered. The farmers demand results in larger or more profitable yields obtained by a system which is not burdensome. The system of dry soil culture here placed before him has been evolved and demonstrated under decidedly dry conditions. It involves important modifications in agricultural implements. The author is convinced that when implement-makers have grasped the underlying principles and catered for them the profitable agricultural zone will be considerably enlarged, and will absorb areas far beyond its reach to-day.

It would be beyond the scope of this paper to go deeply into all the details which build up successful practice; such would require a volume.

It is only attempted to explain underlying principles and those details which are not generally accepted or regarded.

The consideration of the questions of rotation, manuring, &c., would make this paper too voluminous.

Underlying Principles.

Successful agricultural practice largely depends upon a farmer's ability to arrive at a satisfactory conception of the possibilities of his soil and its environment. The sciences have done much to assist him in ascertaining the most desirable physical, chemical, and biological conditions of his soil necessary to obtain maximum results under his conditions. The practical man has first to consider the physical condition of his soil; or, in other words, obtain and retain a satisfactory tilth. In securing such he brings into action chemical and biological forces which very often are sufficient to ensure good crops. If such are not forthcoming he must ask the chemist for assistance, and, if still unsatisfactory, the biologist. Under Australian conditions, with almost limitless areas, the physical, at present, is the most important.

The author claims as his system the production of self-mulching surfaces. These self-mulching surfaces lead to the deepening of the soil, and free access of rains. They prevent evaporation, surface-rooting, germination of weed seeds, and erosion on undulating country, and tend to considerably increase the yields.

In the drier districts wheat is the principal field crop; such, combined with sheep-raising, fits admirably Australian conditions. The principles herein explained have special reference to this crop; they also are applicable to the orchard or cottage garden, and can be advantageously applied in districts of heavy rainfall.

Under dry conditions, or those which preclude good crops by the ordinary methods as practised, it is a combination of cultural details, rather than any individual practice which ensures results.

The new practice must first be grasped, and kept intelligently in view, to be advantageously followed. It, in common with any other system of soil culture, may be abortive in the hands of one individual, whilst entirely satisfactory with another, so much depends upon doing the right thing at the right time.

In discussing the growth of any crop, all the cultural operations and other conditions operating from the time the previous crop was harvested or otherwise disposed of must be taken into consideration. It is not sufficient to give the rainfall during the growth of a crop or the operations during its development if proper conclusions are to be arrived at. The rainfalls and treatment during previous years must be available.

There are four conditions of soil particles deserving of special attention, viz., dust, granules, crumbs, and clods. The aim should be to keep the dust at the bottom, the granules next, then the crumbs, and the clods on top. Whether such is attained depends largely on the skill of the operator and the implements used.

Self-mulching Surfaces.

Self-mulching surfaces may be granular, granular and crumbly, granular, crumbly, and cloddy, or those kept loose and open by incorporating stubble, straw, residues of crops, leaves and roots of grasses and herbs; or may be composed of granular or crumbly clays such as many of the calcareous clays.

The object should be to keep the surface loose and open; no compression should be allowed excepting under exceptional conditions.

The most effective self-mulching surface is one of about 3 inches in depth of gravel about ¼ inch in diameter; through it water percolates freely, and is effectively trapped. Nature must be gone to for examples of this. In semi-arid regions there are considerable areas of gravelly surfaces which would incline to the belief that the soil was barren. The subsoil frequently contains only a small proportion of gravel, that at the surface is the residue from several feet of similar soil; such forms an effective mulch, allowing of plants to thrive incredibly. Nature's teaching throughout is the advocacy of loose surfaces, and demonstrates such most fully. Under natural conditions Nature blows with her winds the finer particles away, washes them away with her rains, covers the surfaces with effective mulches of decaying grasses, herbs, shrubs, and trees, sends roots into the subsoil, conveying with them air and moisture to sweeten it. By extremes of temperature she breaks up and makes friable the clay surfaces, which during droughts are cracked and fissured to fit them for their duty when the rains fall. It is not to be wondered at that man reaps many bountiful harvests from virgin soils after years of Nature's tilling, or that, after droughts, during which the air takes the place of moisture for several feet of the surface, bountiful crops are gathered. Man's occupancy has, in many cases, undone Nature's good work, as if he were to plough under the gravel-mulch in semi-arid districts. His duty is to work with Nature, not against her; if he does he must suffer. The consolidation of surfaces by the excessive tramping of stock has deteriorated, and is still deteriorating, vast areas of land. It will tax man's ingenuity to properly bring them back to their pristine fertility.

The author's attempt to explain the phenomenon of the breaking out of springs during very dry weather led to the investigation of self-mulching surfaces. It has been frequently noticed, during very dry weather, that many natural springs, which had been dry for some time, suddenly break out and flow down creeks in streams several feet wide, and continue flowing for a considerable time, notwithstanding the fact that there had been no rain for several months. The explanation is probably the following:—

The free water of the earth of these districts under normal conditions is forced to the surface by bars of rock or clay in the form of springs. In seasons of good rainfall their flow is normal. This free water is acted upon by powerful pumps over a large extent of soil surface. The pumps are vegetation and the evaporating agents, sun and winds. When vegetation is flourishing, a considerable drain is made upon the free water, and certain springs may stop flowing. The moisture is brought to the roots of herbs

and grasses by capillarity. Trees, shrubs, and, in some instances, grasses, &c., may send some of their roots down to the free water. In droughts the vegetation may die, excepting the hardier trees and shrubs. The sun and winds are thrown out of action by the perfect mulch of the sun-dried surface, the soil particles of which are surrounded by air instead of the moisture film necessary for the free water to ascend by capillarity. The result is that the free water level rises and comes to the surface in the form of springs on account of these pumps being thrown out of action.

Deepening of the Soil.

The land should be ploughed as soon as possible after the preceding crop has been disposed of. It is preferable to plough when the ground is dry, and not moist. If ploughed when dry it invariably turns up very loosely, and perhaps roughly, depending upon the implements used and the nature of the soil. The aim should be to break it up roughly and loosely, and to encourage the coarser particles to remain on the surface in the form of crumbs or clods. This condition is best obtained by using mould-board ploughs so arranged to ensure very loose packing of the furrow slices. In the turning of the slices the finer particles of dust and granules trickle to the sub-surface, leaving the crumbs and clods on top.

A 6-inch ploughing of this description allows the air and other ameliorating agencies to act upon the subsoil, a considerable portion of which is turned into soil. In sod land it may be desirable to turn the furrow slices upon their edges to allow of the deepening of the soil. A finely-worked, closely-packed surface prevents this desirable deepening.

Access of Rains.

Surfaces made up of the coarser, loosely-packed particles allow heavy rainfalls to pass quickly through into the subsoil. If an inch were to fall in half an hour not one point would be lost. A surface of fine particles has an opposite tendency; fine particles pack tightly together upon being wetted. It frequently happens that the first few points of a thunderstorm compact the soil; this sealed surface prevents the escape of the air surrounding the soil particles, without which the rain cannot enter. The result may be the loss of 80 per cent. of the rainfall. Every farmer knows that to fill his water-bag he must not attempt to pour too much water down the neck at once, but rather a neck half full, which allows the air to escape as the water takes its place. If a bag of flour is completely covered with water, the outside particles are wetted, which effectively prevents the escape of the air surrounding those inside, and very little flour is destroyed, although immersed for a considerable time.

Prevention of Evaporation.

When a surface layer is made up of the coarser particles very loosely packed, it cannot retain the moisture to be dissipated by sun and winds. Where percolation is greatest retention is least. The small amount of the precipitations retained by this layer is quickly dried by a few hours' sun

and wind, and the surface is virtually self-mulching. Moisture cannot be brought to the surface by capillarity as quickly as the evaporating agents ask for it. The moisture film is thus replaced by air upon the particles, and capillarity cannot displace it except in well-nigh saturated soils. By placing capillarity at a disadvantage in conveying the moisture to the surface, the moisture is conveyed laterally in the subsoil by the same force. This lateral and downward diffusion amongst the finer particles of the sub-surface disposes effectively of the moisture, and the surface is placed at a decided disadvantage from a capillary standpoint.

Surface Rooting.

A surface of fine particles is ideal from a capillary point of view. Moisture is brought to the surface at the expense of the subsoil. The tilth and moisture of the first three inches encourage surface roots. There is no inducement for the roots to go deeply into the subsoil. In climates of frequent and plenteous showers this is satisfactory. Where droughty conditions prevail surface-rooting is disastrous.

Loosely-packed surfaces unquestionably encourage sub-surface rooting, which should be aimed at.

Germination of Weed Seeds.

The conditions which encourage surface-rooting are favourable for the germination of weed-seeds and their growth whilst young. Many weeds have very small seeds, requiring fine surface tilth for their germination. Loosely-packed, rough surfaces have an opposite tendency.

Erosion.

Soils with very fine particles on top may, under certain conditions, prevent the ingress of heavy rains. That which cannot enter finds its way to lower levels, carrying with it soil and organic matter. On undulating country losses from this cause may be considerable.

Soil Moisture.

Soil gains moisture from precipitations as rains, by condensation as dews, and hygroscopically from the vapour of the atmosphere permeating it. Rains are apparent to everyone. Moisture is condensed from the atmosphere in the form of dew when the soil temperature falls to what is known as dew-point, and dew is formed upon the soil particles. Soils, especially fine soils, possess the power, in common with many other substances, such as salt and sugar, of obtaining moisture from the atmosphere. Such is apparent in the case of salt and sugar, when the air is laden with moisture preceding or during rainfalls. This moisture is termed hygroscopic moisture. Every effort must be made in dry climates to catch and trap all rainfalls, no matter how heavy. Condensed and hygroscopic moisture must be made the most of by allowing it to condense upon and be absorbed by soil particles protected from evaporating agencies. Soils lose moisture through percolation, evaporation, and vegetation.

Australian Soils.

The bulk of the Australian wheat soils are made up largely of very fine particles, and contain but little organic matter; such is to be expected in dry, hot climates. These soils have readily diffusible surfaces. In contradistinction to these there are the calcareous clays, which, upon drying, granulate and crumble.

Dust Mulches.

These are formed by frequent cultivations of the surface. They may be effective under certain conditions, but, generally speaking, these conditions are rare and unstable. Many writers affirm that you cannot work a soil too much. It is very easy, indeed, to work the surface too much. Excessive surface working, especially with disc implements, as is recommended in the American system of dry-soil culture, is attended with very serious disadvantages. When a man wishes to make plaster from a soil he breaks the particles down very finely and mixes them with water to ensure the necessary adhesion. It is very easy to make plaster of a soil. The fine dust allows the hygroscopic and condensed moisture, augmented by the vapour from the sub-surface, to reconstitute the water film around the soil particles. Then the sub-moisture travels up freely by capillarity, and is evaporated, resulting not only in the loss of the hygroscopic and condensed moisture, but an appreciable amount from below. The same occurs under conditions of very light showers of only a few points. These showers have a scalding effect upon the crops when grown under the ordinary system, as is frequently noticed by farmers. Dusty surfaces are not self-mulching. They must be frequently stirred, even without rains. It is not practicable for the busy farmer to be continuously mulching by mechanical means his several hundreds of acres of fallow lands. Dust mulches are a snare and a delusion.

Crusted Surfaces.

Fine particles readily run together with the first heavy rains, and form what are known as crusts. These must be broken by implements if the best results are to be obtained; if not broken, they remain practically unchanged for several months, excluding air and a large proportion of the rains.

Cloddy Surfaces.

Clods pack loosely, and allow of continual changes of the surface. Each wind may chip a piece off a clod or crumb, every frost is certain to do so; extreme fluctuations of temperature also cause fractures, resulting in a mellow and friable condition.

Consolidation of Sub-surface.

Satisfactory consolidation of the sub-surface should be aimed at. The bringing of the coarser particles to the surface by the various cultural implements allows of the finer particles settling together lower down; especially is this the case after a rainfall of an inch.

In order to get an idea of the system it is advisable to go into a garden, press a digging fork obliquely into the soil, and, with a sifting motion, bring the coarser particles to the top—a most desirable surface is the result. It may not be as smooth or as ideal in the ordinary acceptance of the term, as before, yet everyone must admit that the soil has received more cultivation. Critics have claimed that the large extent of surface thus exposed must lead to an undue waste of moisture; such is not the case. The apparent surface is not the evaporating surface after the sun and winds have acted upon it for one hour. In a very short time the actual evaporating surface is protected by the air-dried, sun-baked granules, crumbs, and clods.

Plant Food.

When, owing to imperfect mulching, moisture is allowed to evaporate from the surface of the soil, instead of passing through the plant, it takes with it plant-food in solution, which is deposited at the surface away from the root zone, and is not available until redissolved by rains.

Micro-organisms.

Loosely-packed surfaces are non-conductors of heat. This is of considerable importance under semi-arid conditions. The sub-surface is kept cooler, less moisture is given off in the form of vapour, and the beneficial micro-organisms find more congenial surroundings in the more uniform temperature of the sub-surface.

Rotations.

The question of crop rotation is of considerable importance. Judicious rotation allows of seasonable operations for the profitable application of the best methods. The ploughing under of crop residues, which eventually become humus, brings about a most desirable granulation of the soil particles. Care must be taken not to over-enrich a soil in this manner.

Rich *versus* Poor Soils.

This opens up a most vital point in dry-farming. Methods which leave nothing to be desired with reasonable rainfalls may prove disastrous under semi-arid conditions. Every system needs discussion in relation to the available moisture. Methods possible and profitable with a 20-inch rainfall may be calamitous with one of 15 inches.

Writers frequently affirm that the more organic matter a soil contains the more moisture it will hold, and therefore must be better from a drought-resisting standpoint. Every practical man knows that the richest portions of his field give the lowest yields during very dry seasons. This is due to the fact that a rich surface, or one rich in organic matter, absorbs the greatest bulk of the rainfall. Organic matter retains considerably more moisture than the inorganic soil particles; the trouble is that it is retained at the surface, from which it is readily evaporated. This surface moisture, in conjunction with sufficient plant-food, induces surface rooting, there being no necessity for the plant to root below. This is especially the case

in the late autumn and winter, when evaporation is at its minimum. When the dry weather sets in this limited root zone is soon pumped dry by the crop and evaporating agents. The result is, in many instances, a total failure. The reverse is the case with the poorer sandy soils. Showers of 50 points may permeate a light soil for about 12 inches; the same fall may only moisten the rich soil for about 6 inches. If we assume that in each case the moisture of the first three inches is evaporated, three-quarters of the fall would be available to the plant in the poorer soil, whereas only half would do duty in the rich.

In the poorer soils plants have a relatively larger root system in proportion to their growth above ground than those upon richer soils.

An excessive vegetative system, such as stems and leaves, as is induced upon rich soils, acts as a large pump upon the reserves of soil moisture; if these reserves cannot keep up the demand made upon them until the plant is matured disaster must result. It very often happens that instead of wheat filling its grain under such conditions, it has to be cut for hay. The richer soils, therefore, in dry seasons, are not suitable for grain-growing under the present methods of treatment, but suit rather the growing of wheat for hay.

Hay *versus* Grain.

It is much easier to grow a crop of wheat for hay than one for grain in semi-arid districts. The practice followed for the growth of hay may be disastrous if grain was the objective. Hay can be produced by choosing an early maturing variety, and sowing it upon comparatively rich land, so as to force its growth throughout the late autumn, winter, and early spring, when evaporation is not excessive. If the ears are blasted by a late spring frost, it is not a serious matter; and, if the spring prove unfavourable for hay-making, it may be ensiled. To produce grain, risks from frosting cannot be taken, and the plant must mature during that part of the season when evaporation is considerable. The growing of good crops of hay and good crops of grain, under semi-arid conditions, by the same treatment are not compatible.

Farmyard Manure.

Under dry conditions an application of farmyard manure may ruin a crop. It is not so much the fault of the manure as its application. The ordinary applications are made only to the surface. If organic matter could be incorporated with the subsoil, leaving the poorer soil upon the top, it would increase the water-holding capacity of the soil, away from evaporating agencies, and would certainly induce sub-surface rooting. The inversion of a rich surface by deep ploughing, with subsequent aeration of the unsweetened subsoil, which is brought to the top, by lying up for three months to the weather, may allow of good crops of grain being obtained from soils which ordinarily are considered too rich.

An application of fresh farmyard manure to the surface 3 inches may make it so loose and open as to throw it out of action.

Throwing the Surface out of Action.

This may be attained as above, or by mixing a sufficient quantity of fresh straw or stubble with the first 3 inches, or by bringing the crumbs and clods to the top, and allowing them to remain in a loose condition. This condition does not allow of the retention of moisture sufficiently long to support the vital roots of plants. Farmers are warned against throwing too much of the surface of shallow soils out of action too quickly. The subsoil may not be ameliorated quickly enough to take its place in plant nutrition. It may take several years to increase the depth of a soil 6 inches.

Seeding.

The question of securing germination under the new system is a vital one. It has been explained that weeds are discouraged on account of their seeds not germinating in the loose surfaces. It would be impossible to ensure germination without frequent surface showers by the old-time method of broadcasting. The seed must be deposited below the crumbs and clods, amongst the dust and granules. Such can only be accomplished by special implements. Seed-drills, with ordinary narrow hoes, are capable of placing comparatively large seeds, such as wheat, in a satisfactory position. These hoes push aside the crumbs and clods, deposit the seed, and leave a loose, open surface, through which the blades have no difficulty in getting. Disc drills should not be used. They bring the fine particles to the surface, and have the disadvantage of rolling over any clods, and in doing so leaving the seed upon the surface.

Sub-surface Compressor.

An attachment to the ordinary hoe-drill the author has termed a sub-surface compressor, in contradistinction to the American sub-surface packer. This attachment overcomes any difficulty, and ensures germination under otherwise impossible conditions. A narrow steel bar, attached to hoe, fitted with set screw and pressure, compresses the fine particles around the seed from 2 to 3 inches below the surface. This compressed soil is covered over by granules, crumbs, and clods, thus protecting the compressed portion from evaporation.

It has long been recognised that tramping or rolling the surface ensures speedy germination. It is also known that such operations waste soil-moisture by bringing it to the surface to ensure germination, to be afterwards dissipated by sun and winds. Horses' footprints upon loose surfaces must be looked upon as undesirable outlets for soil-moisture. The sub-surface compression ensures germination, and the loose surface prevents evaporation. By attaching the compressor to the seed-drill compression is obtained exactly where it is wanted, instead of the indiscriminate sub-surface packing of the American implement. The American implement also has a revolving action, with the defects of disc implements as regards bringing the particles of dust to the surface, a defect which this system does not tolerate.

This attachment may be used to advantage with seeds such as rape. The rape is sown in drills, and deposited about $1\frac{1}{2}$ inches below the surface, compressed, and covered with a light, crumbly covering in the same manner as wheat.

Maize is planted by using a similar attachment upon the maize-drill, as well as two miniature mould-boards to push aside the very rough particles, leaving the spaces between the drills in the loosest and most friable condition.

Thin Seeding.

To ensure a limited amount of moisture doing its maximum duty, thin seeding should be practised. This is a most vital point. Nature, under very dry conditions, sows very thinly and gives her plants plenty of room. Grasses may be a yard or more apart; there is no thick sward, as in the moist, humid districts. If it happens that seedlings come up thickly, the weaklings are soon sacrificed, leaving only a few or the fittest to perpetuate themselves. Better results may be obtained from a 10 lb. seeding than from a 30 lb. seeding of wheat under extreme conditions. Plants when growing wide apart in dry climates very often grow surprisingly; the air-dried spaces between are not giving off moisture, and all the sub-moisture is available for the plants.

Transpiring Surfaces.

From a thoroughly mulched soil the main outlet for moisture is through vegetation, and a limited amount is given off in the form of vapour. In the case of a cropped soil, a considerable quantity of moisture is transpired from the surfaces of the leaves of the plants.

A reduction of these transpiring surfaces may, under certain conditions, be of vital importance. When a wheat crop has had a very favourable early growth, considerable leaves are induced of such a nature as to give moisture off rapidly. If this favourable early period is followed by a dry spring the plants attempt to accommodate themselves to the change of conditions by sacrificing these unsuitable leaves, and become tip-withered. New leaves are produced better fitted for the new conditions, and if the plant is successful a revival may set in and seed be produced. It is possible for man to anticipate this and reduce the transpiring surfaces by feeding off judiciously with stock. The author has frequently noticed drought-resistant trees, shrubs, &c., completely change their leaves when a drought breaks. The change is remarkable, and quickly made. The leaves which had functioned throughout a severe drought were not suited to the conditions; they were sacrificed, and their places taken by a new set.

Implements.

Under certain conditions, and with certain soils, it may not be possible to ensure self-mulching surfaces for a considerable period. A farmer is unfortunate in having to work soils which will not mulch themselves after a reasonable application of these principles. Modifications of farm implements will help him materially.

Ploughs.

The action of mould-board ploughs in obtaining loosely-packed surfaces has been mentioned.

Disc ploughs are very unsatisfactory in dry soils of fine particles. The discs carry a considerable proportion of fine dust upon their surfaces, which in revolving spread it as an impalpable powder over the surface. They should not be generally used.

Cultivators.

Those with set tines set obliquely forward do reasonable work. Spring-tooth cultivators, owing to their vibrating action, are effective, yet considerable improvements could easily be made. Disc cultivators make the surface too fine.

In garden practice the digging fork and fork hoe are the most satisfactory. Push-hoes are wrong in principle, as the tramping upon the cultivated surface is disastrous. They should be pull-hoes.

Tests and Demonstrations.

This system has been tested and demonstrated at the Bathurst Experiment Farm for the past seven years under varying conditions, and the results have exceeded the most sanguine expectations. The author has been subjected to adverse criticism respecting what is termed his rough system. Cloddy surfaces are not considered good farming. A self-mulching surface should be respected, even one of clods. Farmers are warned against going to extremes as regards clods. They are advised rather to grasp firmly the true position of the dust, granules, crumbs, and clods of the new system.

Supplementary and Explanatory Notes.

The object is, as far as possible, to retain the compound particles of soil at the surface. Dust may be classed as simple particles; granules, crumbs, the clods as compound. Granular structure is essential to the aeration of the soil.

Cultivation of the actual surface tends to break down the compound into simple particles. Cultivation should be of such a nature as to break up comparatively finely the soil several inches below the surface, and, with a sifting action, to bring the coarser particles of the soil to the surface 3-inch layer.

Definition of Clods.

A clod is a compound particle of soil larger than a crumb. It may be an aggregation of crumbs, or a section of soil compressed tightly, or simple or compound particles cemented together by colloids, such as colloidal clay, ferric salts, and silicates.

In actual practice they vary from the size of a large marble to sections of the furrow slice, the size being determined by the depth, width, and longitudinal fracture of the furrow slice. The whole surface of a paddock

may become a clod, owing to its particular particles setting together by rains to the depth of the ploughing, or owing to the tramping of the surface by stock while it is wet. Such a clod is difficult to break up unless moist, as farmers know to their cost if rain is withheld during the ploughing season.

Quality of Clods.

The most desirable clod is of a granular or crumbly structure, one which weathers comparatively easily. This granular, crumbly structure may be due to the amount of flocculating clay or to humates derived from organic matter.

The most undesirable clod is that made of compressed or simple, rather than compound, particles, in which the colloids or cementing materials are

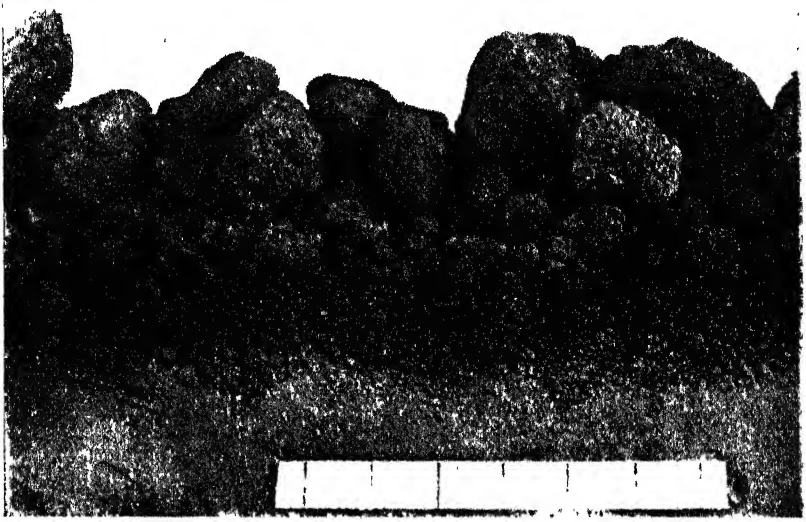


Fig. 1.—The Ideal Soil Structure.

diffused or deflocculated, and possess insufficient clay to allow of alternate expansion and contraction upon wetting and drying.

There are also clods of varying intermediate characteristics. One may weather down by natural agencies in a few weeks, whereas another may take as many months.

Clods should not be too large. Those that interfere with the depositing of the seed below them and float in front of the drill are too large. Drills can work freely amongst 3, 4, or 5-inch clods.

Advantage of Clods.

Self-mulching surfaces may be obtained without clods. Where the soil is lacking in organic matter or coagulating clay to bring about the desirable granular or crumbly structure, clods of varying sizes are extremely valuable to ensure a loosely-packed, open surface. Loosely-packed clods of

any description prevent surface rooting, allow of the free action of ameliorating agents, thus deepening the soil, and allow the bulk of the rains to pass through by gravity instead of being in many instances slowly absorbed or lost. When rain falls through the surface the coarser particles of the clods are left and the finer particles washed into the sub-surface soil, and the granular or crumbly structure is retained at the surface. When rain falls quicker than a soil can absorb it puddles of water are formed on the surface. These puddles contain the finer particles, such as clay, in suspension, and when evaporated or eventually absorbed the granular or crumbly structure of the surface is destroyed, and the interstices through which it is aerated and should receive moisture are blocked up. Crusts are

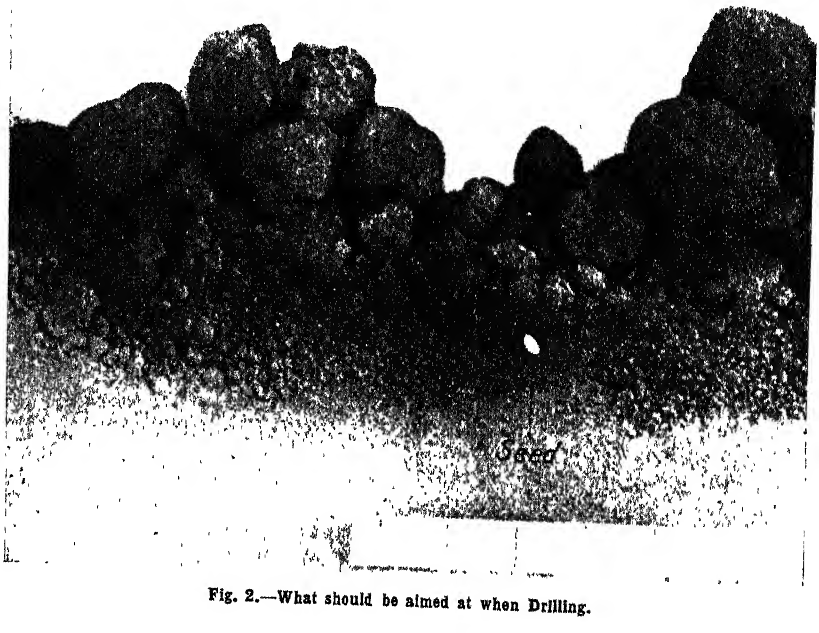


Fig. 2.—What should be aimed at when Drilling.

thus formed which, if good results are to be obtained, must be broken mechanically by implements.

If the surface water flows over the surface soil the desired structure is destroyed, only in a more aggravated form than that just described.

In soils of coarse, open texture, the finer particles are washed to the subsoil, and the coarser gravelly parts remain.

Deep rooting may be induced by cloddy surfaces. Deep rooting is essential to drought-resistance.

Points of Difference.

The main points of difference between what is considered the orthodox system and that advocated herein are that in general practice a seed-bed is

formed out of the top 2 or 3 inches of soil by implements varying in character, the result being a comparatively fine surface calculated to ensure the germination of the seed if only lightly covered. This practice has been handed down by farmers from the time when grain was sown by hand, and crops were cut with the scythe, and gathered with the rake. Those practices required fine surface seed-beds, and smoothed-out fields free from clods, which may otherwise be gathered with the crops.

Fig. 3.—Two different types of Clods.

The system now advocated accepts the seed-drill as an essential, and clods of reasonable size as auxiliaries. The seed-bed is prepared below the surface 2 or 3 inches, the coarser particles of the latter being jealously guarded from compression and any form of breaking down below a certain standard.

Fig. 4.—Weathered Clods.

The crop is harvested by reaper and binder, and the clods on the surface are negligible.

The firm seed-bed deemed so necessary for wheat is brought about by either working the soil fine or rolling after ploughing or sowing, in the system styled as orthodox; whereas, in the one under discussion, com-

pression is ignored, and the firming of the seed-bed is left solely to natural agencies working upon the fine particles below a loose, open surface, the agencies being the superincumbent pressure of the surface and the setting of the particles by rains.

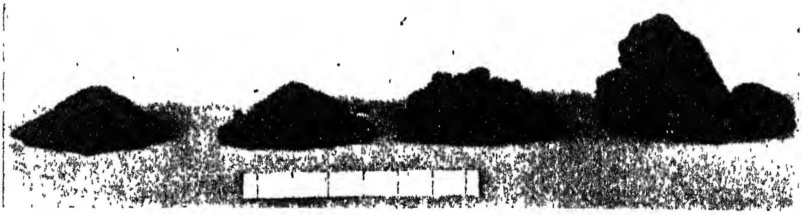


Fig. 5.—Division of Soil Particles, viz., Dust, Granules, Crumbs, and Clods.

To deepen the soil by the old methods, deep ploughing or subsoiling was resorted to. By this new system the soils are deepened by throwing a proportion of the surface out of action, thus allowing weathering agents to act upon the subsoil.

One system aerates the soil for a time by mechancial means, and mechanically closes up the avenues for aeration by compression or breaking a portion of the soil to dust. The new system encourages the air to penetrate as deeply as possible for as great a length of time as possible without frequent cultivations. Implements which fine the actual surface of the soil are sought after in the one system, whereas only those which exercise as near as possible a sifting action on the soil particles, thus bringing the coarser ones to the surface, are tolerated in the other. One operator ensures a surface at the time of seeding which is conventional and is frequently considered indispensable to good farming, but which frequently loses its desirable texture after the first heavy rain, and remains unsatisfactory until it is improved by cultivation. An operator following the methods advocated herein, however, may at seed time obtain a surface which may appear to many to be unsatisfactory, but which will work into condition by rains and other agencies during the growth of the crop, and allow of continual changes of the actual surface without resorting to cultivation for a considerable time.

Fig. 6.—Sub-surface Compressor attached to Hoe of Seed Drill.

Implements.

The ploughs used to bring about most effectively the desirable soil structure are those with long mould-boards arranged to pack the furrow slice slowly and loosely. A mould-board which is short and inverts the slice quickly is unsatisfactory. It is preferable to plough when the soil is dry, so that the finer particles will settle towards the bottom of the furrow. The second ploughing should be across the previous one.

Cultivators with tines set obliquely forward or with spring tines exercise a sifting action, and are satisfactory. They should run across the ploughing, and not with it.

Seed-drills, with hoes set obliquely forward, also allow the finer soil particles to settle below the actual surface. The drilling should be done across the ploughing, or cultivating. No disc implement should be used, excepting where there is too much organic matter, such as straw, stubble, other crop residues, and weeds, to allow of the use of the implements mentioned above.

Implements could easily be devised to obtain the desired result more economically than is possible with those at present at the farmer's disposal.

Considerable judgment and experience are necessary to obtain the best results under varying conditions. This, of course, applies to any farm operations.

Every farmer should have an object prominently in view when performing every operation, the object in the system now under notice being to obtain a surface made up of the loosely-packed coarser particles of the soil and the production of a layer of sufficient thickness of cultivated soil, made up of the finer particles, below the loosely-packed surface layer.

Reference to Illustrations

Fig. 1. "The ideal soil structure." This is what should be aimed at, but would be practically impossible to obtain in actual practice. There would be a greater admixture of the differing particles.

Fig. 2. "What should be aimed at when drilling." The drill-hoe displaces the coarser particles or clods, deposits the seed amongst the crumbs and granules which are compressed around it, thus ensuring the soil moisture ascending to it, and very little further, by capillarity. This compressed portion is covered over by crumbs and small clods falling back behind the hoe. The mulch is thicker between the hoes.

Fig. 3. "Two different types of clods." No. 1 is of a hard, close texture, which requires considerable time to weather. It is produced from a soil which does not granulate or crumble. No. 2 is of a granular, crumbly structure, very susceptible to weathering. It contains organic matter and a larger percentage of clay. The small clods represent the most desirable size.

Fig. 4. "Weathered clods," showing how the rains have washed the finer particles away, leaving the coarser gravel and pebbles exposed.

Fig. 5. "Division of soil particles, viz., dust, granules, crumbs, and clods."

Fig. 6. The "sub-surface compressor" attached to the hoe of the seed-drill, necessary for sowing small seeds as rape, lucerne, &c., but not imperative for seeds as large as grains of wheat.

The Departmental Attitude.

MR. PEACOCK first propounded his original views on soil-culture in a paper read before the Australasian Association for the Advancement of Science at the Brisbane meeting in January, 1909. That paper as then published was not inserted in the *Agricultural Gazette*, because it was deemed to be liable to mislead and to be misinterpreted and misunderstood. Subsequent events have shown that this anticipation was realised, and both newspaper critics and Departmental experts have failed to understand and interpret Mr. Peacock's language and ideas as he would have liked.

It would seem that the phraseology used by Mr. Peacock in that paper was not well chosen, and some words less liable to misinterpretation than "clod," "self-mulching surface," "simple and compound particles," &c., might advantageously be found. Even friendly critics object to the "clods" as seen on the Bathurst paddocks, because they are far too large, consequently do not supply a continuous mulch; they leave a large proportion of the surface soil locked up, or "out of action"; and they interfere very seriously with the operations of the seed-drill. It is only fair to remark that no farmer of ordinary intelligence would "persistently pound at" a soil which sets as the Bathurst soils do. The man who would treat a soil, which sets like cement after a heavy rain, in the same way as he would treat a light sandy loam, or who would "work down" this tenacious granitic soil, and roll it, as he would do with the light sandy loams suitable for market gardening, would hardly be worth calling a farmer, so it is futile to choose such a man as representing the educated agricultural opinion of the State.

The Department has not endorsed the whole of Mr. Peacock's system as outlined by him in his original essay, because generally the other practical men on the staff believe that so much of it as is new will not prove to be true, and what is obviously and admittedly true is not new. Their present verdict is "Not proven." They will need much more proof, apart from mere assertion, than has yet been furnished, and will only be convinced by a demonstration on large areas extending over a series of years. They consider that its value is likely to be local rather than general. They point out that soil like that at Bathurst will "run together" and set badly after heavy rain, whether left in big clods or worked down to a fair tilth, but in the former case the surface will be very rough and uneven, while in the latter it will be more or less smooth and even, and may resemble a

tennis-court more than a cultivated field. In either case the result is disastrous. It is obvious to any trained observer that the Bathurst soil, in spite of the "clod" system, sets badly, as shown by the enormous clods left by the plough. Every farmer recognises the value of enriching his soil with organic matter; also of a bare fallow, left in furrows and not worked down. But he also recognises certain disadvantages, and will be slow to admit any virtue in clods like those to be seen at Bathurst. Seven years' experiments under various local conditions will either convert the agnostics or strengthen their unbelief.

The managers of the Cowra and Wagga Farms, which have granitic soils somewhat similar to those on the Bathurst Farm, though not generally so tenacious, do not work their soil until it sets like cement, nor do they leave great clods when they are working down their fallowed ground for putting in a crop. While seldom aiming at the proverbial ash-bed, they prefer to have on the surface no lumps larger than a walnut to a goose-egg, certainly nothing in size approaching the Bathurst clods. If the soil can be worked when quite dry on the surface, it may safely be worked to advantage even much finer still, so they assert. They are always able to keep it in good condition by the time harrow, the disc harrow, or the scarifier, while, of course, these implements would not even scratch the surface of a soil like that at Bathurst if it had been worked down too finely and subsequently cemented with heavy rains.

On each of the wheat-growing farms a fair trial of equal areas under the two diverse systems of cultivation will be made, and the results will be published year by year. The balance-sheet of the Demonstration Area on each farm over a series of years will also tell its tale, and the honest results of these comparative trials on different farms will prove instructive to every student whose sole aim is knowledge or truth. Meanwhile the whole of this important question is *sub judice* so far as the Department is concerned. Mr. Peacock's ideas are now presented to the *Gazette* readers, with additional notes, in his own words, and every progressive farmer may try the system in contrast with that generally followed in his district.

The orthodox system advocated by Mr. Sutton is presented in his words, and is the one which will be pursued, in contrast with Mr. Peacock's, on an adjoining block at each wheat-growing farm, under conditions as far as possible identical.

For fuller details the student is referred to the series of articles by Mr. Sutton, which commenced in the *Agricultural Gazette* of May, 1909, and were published in bulletin form under the title of "Cultural Methods for Wheat-growing in Dry Districts."

In brief, the principles advocated are:—

That wheat be grown in rotation with other crops, preferably with fodder crops.

That the amount of organic matter in the soil be systematically maintained, and if possible increased.

That a summer fallow precede the wheat crop, and if the climatic conditions require it that it also precede the other rotative crops.

That the fallowed land be worked during the summer in order to maintain a mulch of loose, dry earth, so that the sub-surface moisture may be conserved to destroy weeds, and to prepare a seed-bed.

To give effect to the above principles the following methods are advocated, say, in the Coolabah or Nyngan districts:—

1. The division of the cultivated land into three portions, so that each year one portion will be under wheat, a second under a fodder or other rotative crop, and the third under fallow.
2. The ploughing for all crops should be commenced shortly after the wheat is sown, and should be finished by the beginning of spring.
3. The planting of the wheat on the worked fallow land without re-ploughing, but in a seed-bed with a loose surface, with well-tilled but compacted soil beneath.
4. The planting of such crops as will admit of the practice of inter-tillage in drills wide enough apart to allow of it—this operation to be performed when necessary to maintain a 2-inch to 3-inch mulch of loose, dry earth.
5. Crops sown in narrow drills are to be harrowed if the surface becomes set and the ground is not protected by the foliage of the plants.
6. Working the fallowed land to commence after the wheat harvest is over, and to continue, as required, until the seed is planted.

The implements advocated are:—

For tilling the ground.—Those which are the most suitable for the individual farmer's soil and location, and which are most in accordance with his own preference.

For sowing the seed.—A shoe-drill, if possible with a press attachment.

The implements in use at the Coolabah Farm were:—

Ploughs.—Disc (4 furrow); Mould-board, long boards (3-furrow); Mould-board, long board (1 furrow); Mould-board, short board (1 furrow). The disc plough is preferred.

Cultivators.—Spring-tooth; One-way disc. The former is used for inter-tillage, the latter for working the fallowed land.

Harrows.—Lever tine; Spring-tooth. The latter is only used in lieu of the Spring-tooth cultivator.

For sowing the seed a hoe-drill is used, and as this is not a press-drill, a roller is used to follow the drill and compress the seed into the ground. Attached to the roller is a home-made harrow to reform the loose mulch which is destroyed by the roller.

The methods referred to above are those considered suitable for a district like Nyngan. Though the principles underlying the practice in all districts will be the same, the application of them will vary in different districts. For instance, the same practice would not be followed on the level plains of the hot dry West as would be suitable for the steep hillsides of the cool Bathurst district.

The only object of the Department now is not to prove one man right or another man wrong, but to ascertain facts from which the truth may be deduced—the true aim of every scientific mind.

As the results or facts of these experiments are recorded year by year all of us will become older, and some of us wiser, especially such of us as have to readjust our theories or alter the practice of a lifetime.

Conference of Wheat-growers with Special Reference to Dry Farming.

This Conference, convened by the Hon. John Perry, M.P., Minister of Agriculture, in conjunction with the Farmers and Settlers' Association of N.S.W., was held in the King's Hall, 132, Phillip-street, Sydney, on Monday to Thursday, 18th to 21st July, 1910. In addition to fourteen papers read and discussed, lantern lectures were delivered by Professor R. D. Watt, of Sydney University ("The Conservation of Soil Moisture"); Mr. Geo. L. Sutton, State Wheat Experimentalist ("Dry Farming Methods for New South Wales"); Mr. T. W. Keele, M.I.C.E ("The Great Weather Cycle"); and Senator J. T. McColl ("The Dry Farming Congress in America: Its Work and Results"). Mr. J. M. Paxton, representing the Grain Section of the Sydney Chamber of Commerce, also addressed the delegates on "The Advantages of Fixing an F.A.Q. Standard for Wheat."

Reports of the proceedings were published daily in the Press. More extended notes of the lectures and discussions were taken on behalf of the Department of Agriculture, and these, with the papers read, will shortly be published as a Farmers' Bulletin. Many of the pictures from which the lantern slides were made will also be reproduced in the Bulletin.

Goats and Blackberries.

Mr. Jewell Rutter, of Milton, draws attention to the value of goats as eradicators of the blackberry. He states: "A young billy was bought from me for that purpose, and the little fellow works into the midst of the blackberry bushes, and won't let a young shoot appear." Farmers troubled by this pest may find the suggestion of considerable assistance to them.

In 1903 Mr. G. W. Browne, J.P., of Salt Ash, suggested the use of pigs to uproot the plants, which he stated they would do so effectively in a month or two at the outside that there would be no fear of the blackberries growing again.

Some Aspects of Butter Adulteration.

Composition of Australian Butter.*

M. A. O'CALLAGHAN.

The introduction of scientific principles to butter-making, and of modern machinery into the manufacture, appears to have led the way to a condition of things which make the adulteration of dairy products a profitable business. With the great improvement which applied science and modern machinery have brought about in the quality of butter, a greatly increased demand, and a very much higher consumption of butter per head have resulted. The perfecting of refrigerating processes was the next step, which led to a still further increase in the consumption of butter throughout the world. At one time in the history of the British Isles, and that not very long ago, the price of good butter during winter was so high that it was a luxury to any but the rich. The average man who consumed butter in the winter time in the days prior to refrigeration had to put up with a heavily-salted article which was held over from the summer and autumn manufacture.

The development of refrigeration, however, put a very different complexion on the winter butter trade of Europe. By this means, countries manufacturing butter at great distances from Europe were enabled to deliver in England a lightly-salted butter of high quality, and as the development of dairying in Australia and the Argentine progressed, the quantity of lightly-salted butter of good, sound quality, which was imported into England during the winter months, became so large that the ordinary public were able to obtain good butter during this period of the year at a reasonable price, and as a result the consumption of butter per head throughout the United Kingdom increased very considerably.

With this greatly increased trade, the prospects for the making of money by the manufacturer, and the retailer of imitation butter, became very great, and as a consequence the manufacture of high-class margarine was perfected. As time went on, analytical methods were discovered which aided the detection of foreign fat, and when it was shown that the butters which were being consumed were adulterated to a considerable extent, legal steps were taken by nearly every European country to prevent the sale of these mixtures as pure butter.

The public, however, had been educated that it was possible to make a very palatable substitute for butter, which was not only pleasant to taste, but was also nutritious and wholesome, so that the margarine industry became fully established, and now there is in Europe a large and legitimate

* Paper read before the Butter Factory Managers' Conference, Sydney, June, 1910.

trade done in this commodity. Whenever the price of butter goes unduly high, and hence the prospects for high profits by the sale of imitation butter for the real article become considerable, so are people to be found who sell margarine mixtures for pure butter, and run the risk of detection.

Newer forms of adulteration.

Such a keen eye, however, was being kept on the sale of margarine mixtures by the British authorities, that the ingenious brain of the would-be butter adulterator set to work in other directions, and as a result we got on the market a product which in time became known as "milk-blended butter"; but as milk is mostly water, so, as a matter of course, the amount of moisture per cent. was largely increased, and this new butter substitute became a very profitable article to produce, and to retail.

The butters shipped to England from New Zealand and Australia were found by experience to contain less water than most other butters, and hence the exports from these countries were largely sought after by those who became known to the trade as "butter fakirs," or, in other words, by those who desired to add a considerable amount of moisture to the butter before placing it on the retail market for sale.

British Legislation,

however, stepped in and prevented this article being sold as butter, although it allowed its sale under a special name, containing water up to 24 per cent. At the same time, a limitation was placed on the amount of water which would be allowed in butter manufactured in, or imported into England, the limit being placed at 16 per cent. The Australian butter-maker who prided himself on the manufacture of a dry butter became, in many instances, encouraged to manufacture a butter containing water approximating to the 16 per cent. standard, and as there is no golden rule by which it is possible to gauge with certainty the amount of water which shall be left in a butter, many of those who thought they were manufacturing an article within the legal standard were found to have exceeded it, and during the last couple of months a number of cases have occurred in England, wherein importers of Australian butter have been prosecuted for having imported butter found to have been adulterated by the addition of an excessive amount of water.

New South Wales butter-makers and exporters, however, are able to congratulate themselves on the fact that, so far, no prosecutions have occurred in connection with New South Wales butters. All this credit is not due to the butter-makers, as a number of butters were submitted for export which were found to contain an excessive quantity of water, and were it not for the vigilance of the inspectors under the Commerce Act, no doubt we should have heard, ere now, of prosecutions having occurred in England in connection with butters manufactured in New South Wales.

A bad advertisement for Australian butter.

Because, however, no prosecutions have occurred in connection with New South Wales butters, we do not escape in any way the great disadvantage placed on all Australian butter by the prosecutions above referred to. Each State's butter is sold as Australian butter, and the retail grocer does not, as a general rule, recognise any difference between the butters from the various Australian States. So far as he is concerned, it is all Australian, and I know from past experience that the small grocer is very unwilling indeed to handle any butter whereby he runs the risk of prosecution.

Excessive water in Irish dairy butter.

Before the centrifugal skimming system became generally adopted in Ireland, the manufacture of dairy butter containing water between 18 and 24 per cent. was very general, the excess water having been added in the shape of brine, with the object of improving the keeping qualities of the butter. For many years this class of butter had been in great request, but when modern machinery and manufacture gave the public a drier butter, the question of excess water in Irish butter was raised, and several prosecutions followed, culminating in a final test case at Manchester, wherein the butter merchants organised an able defence, resulting in a dismissal of the case in question, it having been clearly shown that the water was not added for the purpose of fraud.

Considerable damage, however, had been done, and many grocers declined to handle this class of butter at all, despite the fact that the butter merchants were willing to guarantee them against penalty by prosecution. The retailer dreaded the bad advertisement which always follows on a prosecution for adulteration of butter, and decided to turn his attention to those brands of butter which, by their absence of excessive water, guaranteed him against risk of prosecution.

The Australian risk.

Australia has reached a stage when its butter trade is somewhat in the same position as was the manufacture of Irish dairy butter at that time. A few more prosecutions, and our position will not be at all an enviable one. If the retail grocer becomes alarmed, it will take considerable time and good work to overcome his fears of prosecutions; and in connection with this matter, we must bear in mind that we have all the influence of the person whom we have named the "butter fakir" against us, for the simple reason that he objects to our giving him a butter which does not allow him to add as much moisture to it as formerly, and keep within the 24 per cent. limit of milk-blended butter. We also have to contend with the legitimate butter-blender, who uses Australian butter very largely for the purpose of blending with English and other butters, and thereby manufactures a blend of butter in the same way that the merchants manufacture a blend of tea which suits the tastes of their customers, and which they are able to supply throughout the entire year.

Butter Blenders and Irregularity of Quality.

Many butter merchants long ago realised that nothing prevented the development of trade so much as irregularity in quality, or irregularity in the flavour of the butter, even though the butters may be of good class, as customers do not require butter with a Danish flavour one day, an English flavour the next, and an Australian flavour the following week. They, therefore, established a blend of butter to suit the tastes of their customers, and they purchase butter with this object in view throughout the year. We must cater for their requirements if we are to continue to have the high demand that exists for our butters. If we give them a butter containing nearly 16 per cent. of water, it means that they will lose, at least, 2 per cent. of this water in reworking or blending the butter; and, needless to say, they calculate for that loss when purchasing, if they have reason to suspect that the butter contains a high percentage of water. This is one reason why the drier butters are more merchantable, and fetch a better price, than those containing a high percentage of water.

Is the monetary gain worth the risk of bad quality and prosecution?

The more one looks at this question in detail, the more one is inclined to ask the question: "*Is the gain that is possible by the manufacture of a butter on the border line of the moisture boundary worth the risk of the bad advertisement which any factory, or country, is sure to gain if its produce is frequently found on its arrival in England to contain an excessive amount of water?*" No doubt there are individual managers who will endeavour to obtain an extra revenue for their factory by this means, but I am glad to say that this class of manager is a very scarce item in New South Wales. We will, however, have to suffer for the sins of offending managers in other States. New South Wales' managers have thus to face one of two questions: They must either increase the percentage of water, generally speaking, in their butter, so as to bring their manufacture on a par with that of some managers in the other States; or they must make an endeavour to get the standard in Australia fixed on such a basis that it will almost be impossible, with anything like careful supervision, for butter-makers in any of the other Australian States to export a butter which will cause Australian butter to be looked upon as an article which is to be handled with very great care by intending purchasers, if they are to avoid the risk of prosecution.

I need hardly suggest which of the two courses is the wiser one. It is a question of

Water *versus* Quality.

It is a well-known fact that if we increase the percentage of water in our butter to anything like 16 per cent., we shall, without a doubt, cause a falling-off in the quality of our manufacture. The keeping quality is bound to suffer to a considerable extent, because the process of fermentation which is brought about by bacterial agency will be carried on much more rapidly in

the presence of 16 per cent. of water than in 12 per cent. This is forcibly evident when we remember that we are allowed only to add ½ lb. of boron preservative in 100 lb. of butter, and if that ½ lb. of preservative is dissolved in 16 lb. of water, it is certainly a very much weaker preserving solution than if it is dissolved in only 12 lb. of water. All managers should bear this fact in mind when considering this question, namely, that the preservative influence of small quantities of boric acid and salt in butter is due to the fact that they are in a solution in the watery portion of the butter, and hence the butter particles are, as it were, immersed in a solution sufficiently strong to prevent the rapid development of a great many species of germ life. If we add a ½ lb. of boron preservative to 100 lb. of butter, which contains only 12 per cent. of water, we get a watery solution surrounding the butter which contains 4·16 per cent. of boric acid, and the same reasoning holds good with the amount of salt added, together with its preservative action. This is extremely important to those factories whose butters cannot be reduced to and held at low temperatures between the time of packing at factory and shipping in Sydney.

Water *versus* Texture.

A salted butter containing 16 per cent. of water, unless the maker is a very good artist, will undoubtedly be of a weak texture, and will show a lot of free moisture on being tried with the butter borer. Thus the intending purchaser is prejudiced, and will not feel disposed to buy at top prices.

Water *versus* Short Weight.

The intending purchaser who inspects a butter of this character in the way indicated, knows only too well that by the time the grocer has cut such butter up and sold it out in 1 lb. lots, he will have experienced a considerable loss in weight, and hence he will be able to sell a smaller number of pounds from a 56 lb. box of this butter than he could have done from a 56 lb. box of butter containing, say, 12 to 13 per cent. of water; and, needless to say, he does not wish to purchase the watery article, unless at an appreciably lower price. However, before such butter, if made in Australia, has any opportunity of reaching the British grocer, the factory manager who puts it up must run the gauntlet, and risk having the butter "held up" in Sydney, through it being short of the weight marked on the box; because, as all managers know by this time, if the contents of the box do not agree with the trade description, which is indelibly impressed on the outside, the officials under the Commerce Act will prevent its export until the trade description has been amended; and, as a great many of you know from experience, it becomes a very expensive business if the factory manager is detected attempting to export short-weight butter a few times during the year.

A number of these short weights are undoubtedly caused through the butter having contained an excessive amount of water when manufactured. This water leaks into the box, and later on out of the butter-box, so that when it is submitted for export and weighed, it is found that the box does not contain

anything like the amount of butter which the manager thought he had put in. As much as 2 per cent. of water may leak out, and thus the box will be over 1 lb. short weight.

I must add, however, that our good-class factories have not given us much trouble in this direction through excessive water, but, on the other hand, there are some factories

So ill equipped

with refrigerating machinery that they are unable during the warm weather to reduce the temperature of their cream, and of their butter, and thus they must perforce give us a butter containing an undue percentage of water.

Last Season's Water Percentages.

Let us look at the condition of things which prevailed during the export season just ended, as far as water in butter is concerned. During the period 1st July, 1909, to 31st May, 1910, 906 samples of New South Wales export butters have been analysed, and the average water found works out at 13·34 per cent. Of these 906 samples of butter, 700 samples, or 77·2 per cent., gave under 14 per cent. of water, while 147 samples gave between 14 and 15 per cent. of water. This works out that about 93·5 per cent. of the samples taken showed under 15 per cent. of water, so that only a very small percentage of our butters would be affected by a 15 per cent. water standard, and of those that would be affected twenty samples went over the present standard of 16 per cent. As the graders were always looking out for those butters that were likely to contain an excessive amount of moisture, it goes without saying that our export butter on the whole would contain a lower, rather than a higher, percentage of water than is represented by those figures.

The Money Aspect.

Looking at it now from a monetary point of view, we find that those butters which showed between 15 and 16 per cent. of water averaged 15·40 per cent. of moisture, and represented in all 11,188 lb. of butter. This increase of ·40 per cent. of water over, say, 15 per cent. standard, when worked out at 10d. per lb. nett, comes to £18 12s. 11d.; and this is the reason why I ask

Is it worth it—

that New South Wales should run the risk of prosecution in England when the use of what we might call a "buffer area" of 1 per cent. would practically ensure us, with anything like careful supervision of exports, against prosecution in England of the kind which has been given considerable prominence of late? We should bear in mind with regard to these prosecutions that all competitors throughout the world will not forget to remind the British grocers that they run a risk of being prosecuted if they sell Australian butter, whereas, if they sell their own particular goods, they run no risk whatever. It is because of these facts, and also because of the undoubted improvement which a low percentage of water in butter gives over a high one, that I make the suggestion to the managers of our factories that it would

be advisable in their interests to have a "buffer area" of, say, 1 per cent. between them and the Customs officials in England, especially when it is considered that New South Wales managers are not taking the advantage of using the high standard at present in existence, or, in other words, when the loss in money comes to only £18 12s. 11d. per year.

Influences which affect the Water Content of a Butter.

We cannot very well discuss the question of "water in butter standards" without taking into account the influences which affect the percentage of water which shall be found in butter. Under this heading various items have been considered from time to time by different experimentalists throughout the world. I have always found that the items which affect the percentage of water most are temperatures and salt. Under the heading of temperatures we have to consider several things, mainly the temperature at which the cream is churned, the temperature of the water used for washing the butter, and the temperature of the butter during the process of working, and we will now briefly consider these items.

If the temperature of the cream is too high, it is practically impossible to make the butter without churning it into small lumps, and though we may reduce the temperature of the butter by the aid of cold water for washing, still we cannot reduce the temperature of the butter in the centre of these small lumps, though they may not be more than half an inch in diameter. As a consequence, unless such butter is placed in a cold room and thoroughly cooled down and reworked, it will not be possible to manufacture a butter containing a low percentage of water, and even then the butter has to be somewhat overworked before the desired point is obtained.

Action of Wash-water.

Pretty well all managers are aware that the temperature of the water at which the butter is washed has a material influence on the percentage of water which remains in the finished product. All perhaps, however, are not aware that when a temperature for churning of, say, as low as 54 degrees Fahr. is used, the temperature of the wash-water will have a very considerable influence on the percentage of water which remains in the butter. It has been shown, however, by a large number of experiments, that when water approaching 60 degree Fahr. is used for the washing of the butter made from cream at the temperature of 54 degrees, the percentage of water found in a finished butter, all other things being equal, is very much greater than when the temperature of the wash-water was, say, 48 degrees or 50 degrees Fahr.

A series of churning operations carried out by one of the United States experiment stations showed that washing of butter churned at normal temperatures with waters varying from 10 degrees in temperature, produces a difference on the water content of the finished butter of 2 per cent. The

butter with which the water of the higher temperature was used always showed the most water. This comes back to the question of the temperature of the butter during the process of working, and, therefore, on to the question of the firmness of the butter which is being worked, because on this depends, to a very great extent, the percentage of water which remains in the finished product.

If the temperature of the butter during the working process in summer is, say, about 60 degrees Fahr., the butter does not offer sufficient resistance to the worker to enable the machine to press out the water. From this it will be gathered how absolutely necessary it is that the rooms in which butter is worked should be held at a fairly low temperature, if a butter of low-water content is to be manufactured. Of course, a deficiency in the temperature of the working room can be made up for by lowering the temperature of the butter either in a cold room, or by finally washing the butter when in small grains in very cold water, so that during the time it is being worked the butter will remain at a low temperature, and thus enable the excess water to be expressed from it.

Action of Salt on Water Content.

Although unsalted butter has a drier appearance than salted butter, it will be found from a universal experience that the unsalted butter contains a higher percentage of water if manufactured under the same conditions as regards temperature as the salted butter. The reason for this is that the addition of salt to butter sets free a certain amount of water which is easily pressed out of the butter, and it might be assumed as a general thing that the addition of 3 per cent. of salt reduces the water content of the butter by at least 2 per cent., provided the temperature of the butter is not too high.

Black Spot on Citrus Fruit.

Recently claims were put forward for an alleged remedy for Black Spot of Citrus Fruits and other diseases, viz., the application of common washing soda to the base of the trees just below the ground. Mr. W. J. Allen, Fruit Expert of the Department of Agriculture, and Mr. T. Harvey Johnston, Assistant Microbiologist, Bureau of Microbiology, recently visited two orchards in the Rydalmere district, where this treatment had been applied to various trees, but the officers were unable to see any improvement in the trees so treated, which were in no better condition than untreated trees.

These results are confirmed by those of experiments made at Dural, where Black Spot in Citrus Fruits is being investigated, and efforts are being made to determine the most effective preventive treatment.

Burdock Weed.

(*Arctium lappa.*)

THE Chief Quarantine Officer for Plants has informed the Under Secretary for Agriculture of a most extraordinary method whereby an objectionable weed might be broadcasted throughout the State. It appears that as an advertising medium, some printed paper, representative of a flying insect, had been sent to Australia, and the genius who invented this particular style of advertisement, in an endeavour to make it more realistic or uncommon, had attached to each specimen the burr or seed of the noxious weed "Burdock" (*Arctium lappa*).

The authorities in Western Australia had called the attention of the Director of Quarantine to the use to which the burr of this noxious weed was being put. It is needless to say that business firms stopped the issue of the advertisement under notice as soon as they knew there was a serious objection to its use.

The Government Botanist reports that the Burdock has not been recorded from New South Wales so far as he knows, but it would be strange if it does not occur in this State, since it has appeared in Victoria and Queensland. In the latter State it was only reported from Mackay in the year 1902, so that it is there quite a recent introduction. It does not appear to have been recorded from Tasmania, South Australia, or Western Australia.

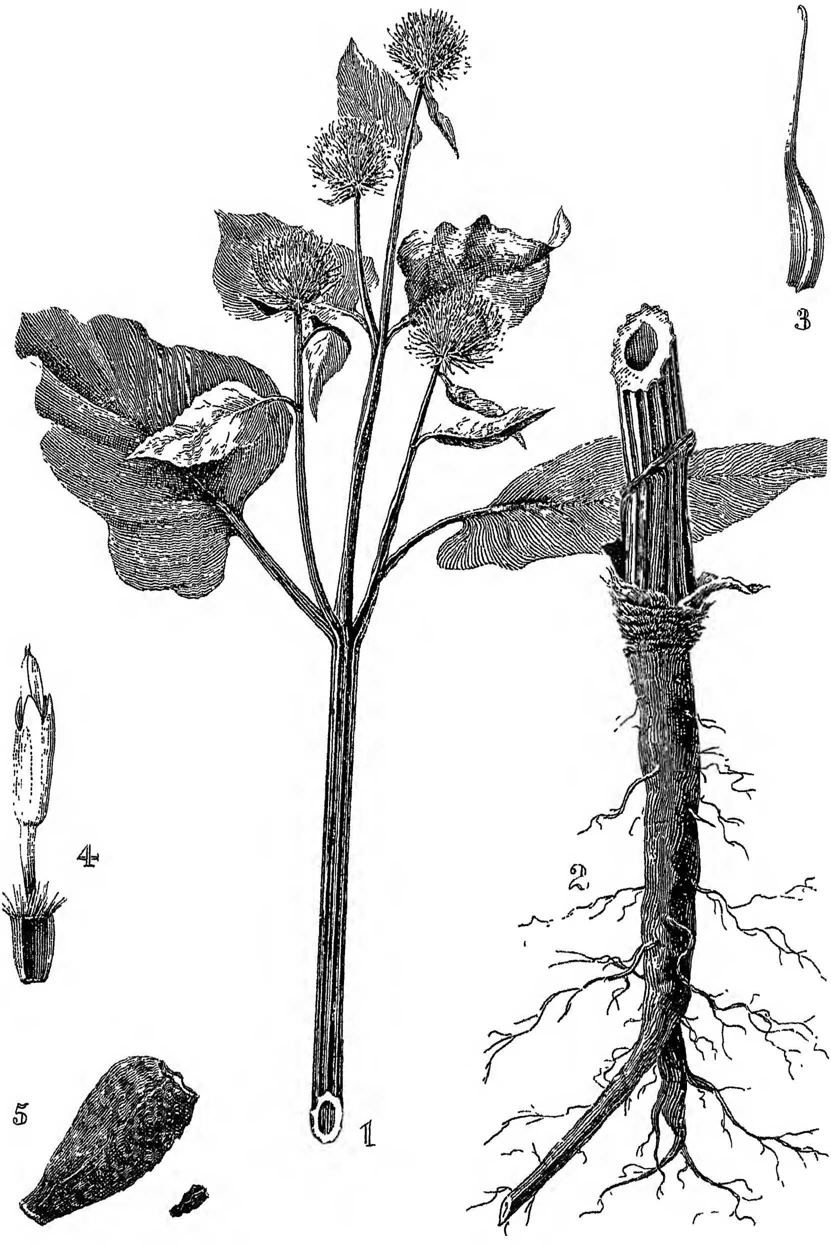
In New Zealand it is a pest, and the Department of Agriculture in that Dominion has issued a leaflet on the subject referring to an allied species. All the specimens are more or less a nuisance.

In conclusion, Mr. Maiden says:—"I quite agree that every precaution should be used to exclude this and other pests from New South Wales. The Burdock is capable of doing untold mischief to the farmer in the colder districts of this State."

The Burdock is a noxious weed in the United States. In the State of Wisconsin it is included in a list of plants in a section of the law dealing with weeds and their destruction by owners or occupiers of land.

In the State of Ohio it is also mentioned as an objectionable weed, and in a bulletin issued by the Ohio Agricultural Experiment Station it is described in the following terms:—

> Burdock: With its very large rounded leaves, tall stems, having small heads of purplish flowers, the burdock is scarcely unknown. The heads become armed with hooked tips, making them like the burrs of Xanthium in adhesiveness. They prove vile pests in the wool of sheep and in the manes of horses. The plant has very large, deep roots; seeds light-brown, spotted with darker, wider above, one-twelfth inch long, with occasional lines longwise, and a short, bristly pappus.



BURDOCK (*Arctium lappa*).

1 Branch with leaves and flower-heads.
2. Root with base of the stem.
3. One involucral bract of the flower-head.
4. One flower of the flower head, showing young fruit with pappus (converted calyx) corolla and the exserted anthers connate round the style.
5. Ripe fruit, the pappus rubbed off.

The seed is also found in Ontario; it is there described:—

Burdock, Great Bur, Clot-bur, or Beggar's Button (*Arctium lappa*). A biennial weed with tremendous roots, probably the largest of all weed roots. This root is uniform in size for a foot below the surface; further down it is much branched, and has a great hold on the ground. The stem is much branched (from 4 feet to 6 feet high) and rough, with broad rounded leaves, the lower surface of a lighter green than the upper. The flower heads occur in clusters, and are purple in colour. The flower receptacle, or involucre, as it is called, is composed of hooked spines, which are very adhesive, and do much injury to the wool of sheep. Dispersal—chiefly by animals carrying the seed from place to place. Eradication—cut below the crown with a spud and burn the tops.

Attention is called to the fact that there are penalties which may be imposed upon persons introducing noxious insects or pests into Australia under Part VII—Miscellaneous—of the Commonwealth Quarantine Act. Section 67 reads as follows:—

(1) No person shall knowingly import any noxious insect, or any pest, or any disease germ or microbe, or any disease agent, or any culture virus or substance containing any disease germ or microbe, or disease agent, or any goods, or any animal or plant, or any part of any animal or plant in contravention of this Act, or any proclamation under this Act, Penalty, £500. (2) In any prosecution under this section the burden of proving want of knowledge shall lie upon the defendant.

Sore Fingers from Milking.

It is reported that on the Bellinger a pretty common complaint is a form of eczema on the fingers from milking. The trouble appears to commence around the quick of the nails, then small watery blisters are formed, which turn to matter, and are very painful.

The Public Health Department states that thorough washing of the hands with borax soap, both before and after milking, with subsequent dressing with enough lanoline to make them slightly greasy, will probably cure the trouble.

Choko Pickle.

Cut up into small pieces about eight chokos, sprinkle with salt and let stand for twenty-four hours, then drain all the water off. Peel about 3 lb. pickling onions, also cut up about ¼ peck beans, sprinkle both with salt and let stand for twelve hours, then drain off all water. Put 2 quarts vinegar on to boil, adding 1 oz. allspice, 2 oz. ground ginger, six (6) chillies, and 2 lb. black sugar. When the vinegar just comes to the boil put in your chokos, beans, and onions; boil for ten minutes; then mix together with vinegar two dessert-spoonfuls of mustard, same quantity of curry powder, and one cup of flour, and add to chokos, &c. Then boil all for five minutes, remove from fire, let cool a little, and bottle.

Orchard Notes

W. J. ALLEN.

August.

Winter spraying with the lime, sulphur and bluestone solution (which is not only an insecticide but a fungicide) should be commenced towards the end of the month, and a sharp lookout should be kept for aphis on peach trees. Resin and washing soda, tobacco wash, or nikoteen will be found useful in keeping the latter pest in check.

Also keep a careful lookout for the appearance of woolly aphis and mussel scale; and should any trees be found affected, they should be carefully pruned, removing and burning as many of the infested twigs as possible. Spray thoroughly when the buds begin to swell and before they burst, with red oil emulsion.

Keep all fruit-houses as clean as possible, as there is no doubt they are responsible for harbouring a great many moths every year.

Growers who intend using quick-acting fertilisers, should make the first application this month. It is better not to apply too much at one time, but rather make two applications—one now, and one after the fruit is set. In the drier districts, where late rains are uncertain, it is better to make the application earlier than late, as it is well known that they do not give the same results if applied when the soil is at all dry.

The latter part of this month is a good time to start the grafting of deciduous nursery stock; and should there be any unprofitable apple, pear, or other trees standing in the orchard, these also may be grafted to good varieties.

It is surprising how few orchardists grow table grapes even for their own use. There is nothing more refreshing in the summer time than a bunch of grapes, and every orchard should contain a small plot. The best varieties to grow in a cool district are White Royal Muscadine, Golden Chasselas, Ferdinand de Lesseps, Black Hamburg, Black Champion, Blue Imperial, and Muscat Hamburg; whilst for warmer districts the following will do best:—Waltham Cross, Black Tokay, Daria, Cornichon (purple), Doradillo, Flame Tokay (a pink grape), and Gordo Blanco.

Green manures may be ploughed under so that the plant-food locked up in them may be available when the tree requires it to mature its fruit. If the green crop is left too late, moisture which can ill be spared if the summer is a dry one, is pumped out of the ground.

Plant young citrus trees towards the end of the month.

See that all pruning is completed with as little delay as possible. Citrus trees may be pruned the latter part of this month.

Whilst in the Wentworth and Menindie districts last month I found Jonathan apple trees growing well, and was informed that the trees bore well. The system of pruning adopted was, after the second year to leave plenty of lateral growth, which developed good fruiting spurs, and the trees eventually carried heavy crops of fruit; but where trees were cut back heavily they bore only a few specimens. Rome Beauty and Stone Pippin were also doing well.

Government Stud Bulls available for service at State Farms, or for lease.

Breed	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ..	Pansy 4th (imp.).	Wollongbar Farm	†
,, ...	March Pansy ...	Earl March ...	Australian Pansy.	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II. ...	Thessalian (imp.).	Egyptian Princess (imp.).	Wagga Exp. Farm	*
,, ...	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm ...	*
,, ...	Golden Lord ...	Golden King (imp.).	Colleen (imp.)	Wagga Exp. Farm	*
Guernsey ...	Gentle Prince ...	Rose Prince (imp.).	Gentle ...	Rous Mill... ...	5 Sept., '10.
,, ...	The King's Mirror.	Calm Prince ...	Vivid (imp.)...	Cumbalum ...	10 Oct., '10.
,, ..	Star Prince ...	Calm Prince ...	Vivid (imp.)...	Dunoon	3 Sept., '10.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir(imp.)	South Woodburn..	21 Sept., '10.
,, ...	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Wollongbar Farm	*
,, ...	Claudius ...	Golden Star II..	Claudia's Pride(imp.).	H.A. College, Richmond	*
,, ...	King of the Roses	Hayes' King ...	Rose 8th (imp.)	Berry Farm ...	*
,, ...	Royal Preel ...	Otchen Royal ...	Hayes' Lily du Preel (imp.).	,, ,,	*
Red Poll ...	The Judge ...	Barrister (imp.)	Lovely 8th (imp.).	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General (imp.)...	Judy 9th (imp.)	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Auchenbrain Spicy Jock (imp.).	Howie's Spicy Robin.	Another Mayflower.	Berry Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ...	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Dan of the Roses	Daniel of Auchenbrain (imp.).	Ripple Rose...	H.A. College, Richmond	*
Kerry... ...	Kildare II ...	Kildare (imp.)...	Belvedere Bratha 3rd (imp.).	,, ,,	*
,, ...	Bratha's Boy ...	Aicme Chin (imp.).	Bratha 4th .	,, ,,	*
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Holstein ...	Hollander ...	Bosch III. (imp.)	Margaretha (imp.).	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

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Department of Agriculture,
Sydney, 2nd August, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

HOLSTEINS.—Maastricht: sire, Obbe II; dam, Lady Margaret; calved 26th June, 1908. Price, **£15.**

Count Wittereen: sire, Obbe II; dam, Lolkje Zuyder Zee; calved 27th November, 1908. Price, **£15.**

AYRSHIRES.—*Border Chief: sire, Auchenbrain Spicy Jock (imp.); dam, Rose Berry; calved 3rd December, 1908; colour, brown and white. Price, **£20.**

Rose Berry, by Mischiefmaker (imp.), from Roseleaf of Barcheskie (imp.). Rose Berry is a large brown and white cow of great dairy type, with good teats.

***Lord Roseberry:** sire, Auchenbrain Spicy Jock (imp.); dam, Primrose II; calved 15th December, 1908; colour, brown and white. Price, **£20.**

Primrose II is by General from Miss Prim. Miss Prim is by Mischiefmaker (imp.), from Primrose of Barcheskie (imp.). Primrose II is a beautiful cow, showing great milking and show type, with large teats and udder. Miss Prim is pronounced by our best judges to be one of the best cows in the State. A recent visitor from New Zealand declared they had no cows to compare with Rose Berry, Primrose II, and Miss Prim.

GUERNSEYS.—*Prince of Parsons: sire, Prince of Light; dam, Parson's Red Rose (imp.); calved 2nd April, 1909; colour, lemon and white. Price, **£50.**

Prince of Light, by Rose Prince (imp.), from Vivid (imp.).

***Harmony:** sire, Calm Prince; dam, Hayes' Muzette 7th (imp.); calved 13th October, 1909; colour, lemon and white. Price, **£40.**

Calm Prince, by Rose Prince (imp.), from Gentle. Gentle, by Masher (imp.), from Calm (imp.).

***Dante:** sire, Prince Milford; dam, Angelica 8th (imp.); calved 14th July, 1909; colour, fawn and white. Price, **£40.**

Prince Milford, by Rose Prince (imp.), from Flaxy (imp.). Angelica 8th, by Captain Powell, from Angelica.

HAWKESBURY AGRICULTURAL COLLEGE.

AYRSHIRES.—Dado: sire, Daniel of Auchenbrain (imp.); dam, Dot, by Hover of Southwick (imp.), from Flirt, by Heir of Randwick (imp.), from Lady of Randwick; calved 23rd March, 1904; colour, white and brown. Price, **£20.**

Emerald's Mischief: sire, Prince Emerald (imp.): dam, Miss Prim, by Mischiefmaker of Barcheskie (imp.), from Primrose of Barcheskie (imp.), by Royal Stuart of Glenbuck, from Lindsay 7th of Barcheskie; calved 4th August, 1903; colour, white and red. Price **£30.**

WOLLONGBAR EXPERIMENT FARM.

GUERNSEY.—Admiral du Preel: sire, The Admiral; dam, Hayes' Lily du Preel IV (imp.), 6903, from Hayes' Lily du Preel III, 6166, by Hayes' Royal, 1674; calved 4th April, 1909; colour, lemon and white. Price, **£45.**

HOLSTEIN.—De Wet: No. 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909. Price, **£10.**

The prices indicated are at the places named, or on rail.

H. C. L. ANDERSON,
Under Secretary.

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* Applications for these bulls will be held till 21st August. If more than one application be received for any one bull, his disposal will be decided by ballot.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agri culture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Corowa P., A., and H. Society	J. D. Fraser	Aug. 16, 17
Coolamon A. and P. Association	J. W. Skien	,, 17
Forbes P., A., and H. Association	H. J. Brooke	,, 17, 18
Gunnedah P., A., and H. Association	M. C. Tweedie	,, 23, 24, 25
Murrumbidgee P. and A. Association	A. F. D. White	,, 23, 24, 25
Parkes P., A., and H. Association	G. W. Seaborn	,, 24, 25
Grenfell P., A., H., and I. Association	Geo. Cousins	,, 30, 31
Wyalong District P., A., H., and I. Association	T. A. Smith	,, 30, 31
Junee P., A., and I. Association	T. C. Humphrys	,, 31, Sept. 1
Young P. and A. Association	G. S. Whiteman	Sept. 6, 7, 8
Ariah Park P., A., H., and I. Association	A. T. White	,, 7
Germanton P., A., and H. Society	J. S. Stewart	,, 7, 8
Cowra P., A., and H. Association	J. T. Martin	,, 13, 14
Albury and Border P., A., and H. Society	W. I. Johnson	,, 13, 14, 15
Ganmain A. and P. Association	J. H. Ashwood	,, 14
Moama A. and P. Association	J. C. Smith	,, 14
Northern A. Association (Singleton)	H. A. Bennett	,, 14, 15, 16
Cootamundra A., P., H., and I. Association	T. Williams	,, 15, 16
Canowindra P., A., and H. Society	G. Newman	,, 20, 21
Temora P., A., H., and I. Association	John Clark	,, 20, 21, 22
Millthorpe A. and P. Association	R. H. French	,, 27, 28
Adelong P. and A. Association	A. W. Molineaux	Oct. 4, 5
Crookwell A., P., and H. Society (Spring Show)	M. P. Levy	,, 7
Mullumbimby A. Society	N. Neilsen	Nov. 9, 10
Tweed River A. Society (Murwillumbah)	A.E. Budd	,, 16, 17
Lismore A. and I. Society (State National Show)	T. M. Hewitt	,, 22–25

1911.

Kiama A. Association	R. Somerville	Jan. 25, 26
Alstonville A. Society	W. W. Monaghan	Feb. 8, 9
Berry A. Association	C. W. Osborne	,, 8, 9
Coramba District P., A., and H. Society	H. E. Hindmarsh	,, 15, 16
Shoalhaven A. and H. Association (Nowra)	H. Rauch	,, 15, 16
Gunning P., A., and I. Society	J. L. Sands	,, 22, 23
Kangaroo Valley A. and H. Association	J. Moffit	,, 23, 24
Southern New England P. and A. Association (Uralla)	W. C. McCrossin	,, 28, Mar. 1, 2
Inverell P. and A. Association	J. McIlveen	,, 28, Mar. 1, 2, 3
Gundagai P. and A. Society	A. Elworthy	Mar. 7, 8
Bangalow A. and I. Society	W. H. Reading	,, 7, 8, 9
Tenterfield P., A., and M. Society	F. W. Hoskin	,, 7–11
Bombala Exhibition Society	W. G. Tweedie	,, 8, 9
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	,, 8, 9
Crookwell A., P., and H. Society (Annual Show)	M. P. Levy	,, 9, 10
Berrima District A., H., and I. Society (Moss Vale)	I. Cullen	,, 9, 10, 11
Central New England P. and A. Association (Glen Innes)	G. A. Priest	,, 14, 15, 16
Bellinger River A. Association (Bellingen)	S. S. Hindmarsh	,, 15, 16, 17
Mudgee A. Society	H. Lamerton	,, 15, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	,, 16, 17, 18
Luddenham A. and H. Society	W. Booth	,, 21, 22
Armidale and New England P., A., and H. Association	A. McArthur	,, 21–24
Camden A., H., and I. Society	C. A. Thompson	,, 22, 23, 24
Blayney A. and P. Association	E. J. Dann	,, 28, 29
Yass P. and A. Association	W. Thomson	,, 29, 30
Cooma P. and A. Association	C. J. Walmsley	April 5, 6
Dungog A. and H. Association	C. E. Grant	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	,, 5, 6, 7

Society.	Secretary.	Date.
Royal A. Society of N.S.W. (Sydney)... ...	... H. M. Somer	... April 11–19
Queanbeyan P., A., H., and I. Association ...	... E. C. Hincksman	,, 12, 13
Bathurst A., H., and P. Association	... A. H. Newsham ..	,, 26, 27, 28

Contributions to the Farrer Memorial Fund.

Name.	Address.	£	s.	d.
Amount received up to 21st June, 1910 ..		633	19	10
F. H. Chaffey	Nemingha House, Tamworth	1	1	0
S. Pollock	Glengarry, *via* Quirindi	1	1	0
E. J. Lowe	Gulgong	2	2	0
G. C. Sparks	Wyong	1	1	0
K. Warburton	Singleton	0	10	6
P. and A. Association	Inverell	2	2	0
E. E. Griffiths	Coopernook	1	1	0
F. and S. Association	Hillston	5	5	0
P. and A. Association	Coonamble	2	2	0
John See & Co.	Sydney	1	1	0
N. Joubert	Chinderah	1	1	6
L. E. Schmidt	Eumundi, Queensland	0	10	6
J. B. McGovern	Tamworth	1	0	0
J. G. R. Bryant	Department of Agriculture	0	5	0
A. B Goard	Byron Bay	0	3	0
G. R. Campbell	Burrendong	0	10	6
A. W. Matthews	Canowindra	1	1	6
F. and S. Association	Forbes	2	2	0
Do do	Bedgerabong	1	1	0
P., A., and H. Association	Forbes	5	5	0
P. and A. Society	Wellington	3	3	0
H. J. Crow	...	0	10	0
H. Simons (Limited)	Sydney	2	2	0
P. and A. Society	Henty	1	1	0
A. and P. Association	Millthorpe	2	2	0
Northern Agricultural Association	Singleton	2	2	0
P., A., and H. Association	Gunnedah	1	1	0
Winter School for Farmers	Hawkesbury Agricultural College	15	0	0
P., A., H., and I. Association	Ariah Park	2	2	0
Commercial Banking Co. of Sydney (Limited)	...	10	0	0
F. Ditzell	Cowra Experiment Farm	0	10	0
P., A., H., and I. Association	Wyalong	2	2	0
R. Gagie	Wyalong	1	1	0
W. Kearsley, M.P.	Newcastle	0	10	6
C. T. Hindmarsh	Gerringong	1	0	0
V. Bruce Rogers	Oreel, *via* Wee Waa	0	5	0
M. H. Reynolds	Department of Agriculture	0	10	0
P. C. Clements	Blayney	0	5	0
G. A. Young	Bundaberg, Queensland	1	10	0
G. D. Robey	"Millbank," Quipolly	1	0	0
J. Crossing	Oakey Camp, Goolma	1	0	0
W. L. Waterhouse	Davuilevu, Fiji	2	2	0
G. N. Barker	Quirindi	1	0	0
P. and A. Society	Glen Innes	5	5	0
A. and P. Association	Blayney	1	1	0
F. and S. Association	Berry Jerry	1	0	0
Do do	Tumbarumba	1	0	0
Do do	Colinroobie	3	12	0
Do do	Sebastopol	1	0	0
Do do	Reefton	2	2	0
Do do	Parkes	7	9	0
R. Thornton	"Congi," Wollun	0	10	0
Wheat-growers' Conference	Sydney	3	3	6
H. F. Buckland and Sons	Gumble, *via* Molong	1	1	6
P., A., H., and I. Association	Queanbeyan	2	2	0
Total amount received to 23rd July, 1910		£745	10	10

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Varieties of Potatoes.—Irvine Ruby

Varieties of Potatoes.—Coronation.

Varieties of Potatoes.—Brownell's Beauty.

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

Trial of Varieties of Potatoes, 1909-1910.

GEORGE VALDER, Chief Inspector of Agriculture.

The evidence obtainable regarding the yield and market value of the many varieties of potatoes grown in this State was so conflicting that it was decided to commence a series of comparative trials, to be conducted in all the leading potato-growing districts, in order to obtain some definite information on the point. A start was made with a trial of eight of the best known varieties, as follows:—

1. Bliss's Triumph.
2. Brownell's Beauty.
3. Cambridge Kidney.
4. Coronation.
5. Early Rose.
6. Manhattan.
7. Irvine Ruby.
8. Satisfaction.

Seed of these eight varieties was obtained from leading growers and made up into sets of 1 cwt. each, this quantity being considered sufficient to plant one-eighth of an acre. The eight varieties, therefore, made up an acre trial plot.

Plots were offered and selected upon the farms of the following growers:—

North Coast.—Murwillumbah—A. J. T. Brown.
Wollongbar Experiment Farm.
Grafton Experiment Farm.
West Maitland—Hunter River A. and H. Association.

South Coast.—Unanderra—L. Carr.
Dapto—G. Lindsay.
Milton—J. Boag.
Kangaroo Valley—J. Chittick.
Exeter—F. Jensen.

North.—Tenterfield—J. F. Chick.
Glen Innes Experiment Farm.
Guyra—T. E. Sole.
Narrabri—J. B. Brake.

South.—Cooma—M. J. Murry.
Jindabyne—Jindabyne West Estate.
Batlow—O. Barberie.
Tumbarumba—J. Eisenhauer, Rosewood.
Yanco Experiment Farm.

West.—Millthorpe—C. H. Shepherd.
Mudgee—V. Cox.
Orange—A. and P. Association.
Mount Irvine—C. P. Scrivener and H. B. Morley.

The seed was treated by the Inspectors as follows :—

A solution was made of 8 oz. commercial formalin to 15 gallons of water. The seed was soaked in this for two hours and then cut and planted in the usual way. It was found that the 15 gallons were more than sufficient to treat the 8 cwt. of seed, and it may be calculated that 30 gallons of this solution would be quite enough to treat 1 ton of tubers. In one or two cases the potatoes were treated some little time before planting, but this does not matter, provided they do not come in contact with affected potatoes. The reason for treating some length of time beforehand was that the seed was commencing to sprout, and it was therefore advisable to treat early so that the formalin should not injure the tender young shoots.

Planting extended from as early as the end of July in the warm districts till as late as November in some of the cold districts. The larger potatoes were cut after they had been treated, and the smaller ones planted whole. They were usually planted in drills 2 feet 9 inches by 15 inches ; and in order that each cwt. of seed should cover the eighth of an acre, it was found necessary to make the sets rather small ; in fact, the conclusion arrived at was that it would be wiser to plant half a ton to the acre instead of 8 cwt. All the plots were manured with the following fertiliser, recommended by Mr. Guthrie in his Bulletin on fertilisers, at the rate of 4 cwt. per acre :—

Potato Fertiliser.

	Quantity per half ton.	Cost. £	s.	d.
Dried Blood	4 cwt.	1	12	0
Superphosphate	4 „	1	0	0
Sulphate of Potash	2 „	1	9	0
Total	10 cwt.	£4	1	0

Containing—Nitrogen ... ... 5·3 per cent.
Phosphoric Acid ... 6·8 „
Potash ... ... 10·4 „

Applied at the rate of 4 cwt. per acre, this will give :—

$\left.\begin{array}{l}23\frac{3}{4}\text{ lb. Nitrogen}\\30\frac{1}{2}\text{ lb. Phosphoric Acid}\\41\frac{1}{2}\text{ lb. Potash}\end{array}\right\}$ per acre ;

and costs about £1 12s. per acre.

The attached table shows the complete returns from the various districts.

Potato Experiments – Season 1909-1910.

	Irvine Ruby.	Satisfaction.	Brownell's Beauty.	Manhattan.	Bliss's Triumph.	Cambridge K dney.	Early Rose.	Coronation.
	tns. ct. qr. lb.	tns. ct. qr. lb.	tns. ct. qr. lb.	tns. ct. qr. lb.	tns. ct. qr. lb.	tns. ct. qr. lb.	tns. ct. qr. lb.	tns. ct. qr. lb.
North Coast—								
Murwillumbah	4 5 2 0	9 8 1 12	9 7 2 0	6 18 3 0	7 4 2 4	7 13 0 12	5 2 3 24	6 17 3 16
Wollongbar	5 1 3 4	6 16 0 26	8 13 1 24	5 17 3 18	5 14 2 16	4 18 2 8	4 15 1 6	... .
Grafton	5 6 1 24	3 12 3 14	2 18 2 4	3 14 1 22	3 16 0 2	4 10 0 18	4 4 3 12	....
West Maitland	9 13 1 15	6 19 1 20	5 0 1 25	....	5 8 3 10	3 6 3 26	3 19 0 18	.. ..
South Coast—								
Unanderra	3 17 3 16	2 14 0 0	2 10 0 0	1 7 0 0	2 12 2 0	2 15 0 0	1 1 0 0	2 7 2 0
Dapto	1 17 3 20	0 18 0 0	1 10 1 12	0 17 2 20	0 12 3 12	1 14 3 24	1 8 0 12	0 10 3 20
Milton	2 17 0 2	2 18 2 0	6 4 0 8	3 3 0 0	1 16 2 16	4 4 0 8	3 8 3 4	6 8 2 8
Kangaroo Valley	3 18 1 4	2 9 2 24	2 3 2 24	2 0 1 4	2 4 3 12	3 4 2 8	1 17 2 24	2 5 0 16
North—								
Tenterfield	4 15 2 4	3 10 2 4	4 9 2 26	2 5 2 4	2 13 2 18	5 13 1 6	1 18 1 16	6 18 0 14
Guyra	... .	....	3 8 0 0	3 9 0 0	3 1 0 0	5 3 0 0	1 19 0 0	5 6 0 0
South—								
Jindabyne	7 11 0 7	4 0 1 1	4 14 1 23	....	2 9 0 4	2 0 1 4	2 16 2 14	....
Batlow	6 9 2 0	4 15 0 0	4 3 0 0	4 5 1 0	1 17 0 0	9 9 0 0	3 1 0 0	7 10 0 0
Tumbarumba	4 1 1 0	4 4 1 0	5 18 0 0	5 2 1 14	8 6 3 21	4 19 0 0	2 13 0 0	4 15 2 14
West—								
Mudgee	4 6 0 1	2 6 3 6	3 3 2 13	2 13 0 26	1 10 2 27	3 3 2 1	2 3 2 3	3 5 0 25
Orange	....	2 10 1 7	3 4 2 26	3 10 3 21	3 4 2 0	3 1 1 27	2 16 2 17	....

Of the twenty-two plots planted, fifteen experimenters sent in complete returns, while the remaining seven failed to complete the experiment, for the following reasons:—

At Exeter, the crop, which promised well in the early stage of growth, failed through the attacks of eel-worms. The plot at Glen Innes failed through continued heavy rains causing the tubers to rot in the ground. At Narrabri the plot was destroyed in the big flood At Cooma the crops failed through drought and late frosts. At Yanco the plants were completely eaten off by grasshoppers. At Millthorpe the experiment was spoilt through sheep breaking into the plot and eating off a portion of the crop. At Mount Irvine the experiment was not completed owing to an outbreak of blight.

The season seems to have been a particularly trying one in many districts. For instance, Mr. M. H. Reynolds, Inspector for the Western District, reported as follows in connection with the Orange plot:—

> Insect pests and the dry spell at the time the tubers were swelling materially affected the percentage of marketable potatoes and also the yield. First a severe visitation of Rutherglen bug on the foliage affected all severely except Cambridge Kidney. Then a dry spell, and finally the potato moth, proved particularly disastrous to Early Rose, Bliss's Triumph, and Satisfaction. The potato moth only affected Cambridge Kidney in a minor degree, while Manhattans were comparatively free.

On referring to the table it will be seen that in some cases the returns for one or two varieties are not given. The reason is that the seed was found to be more or less diseased, and was therefore not planted but was destroyed.

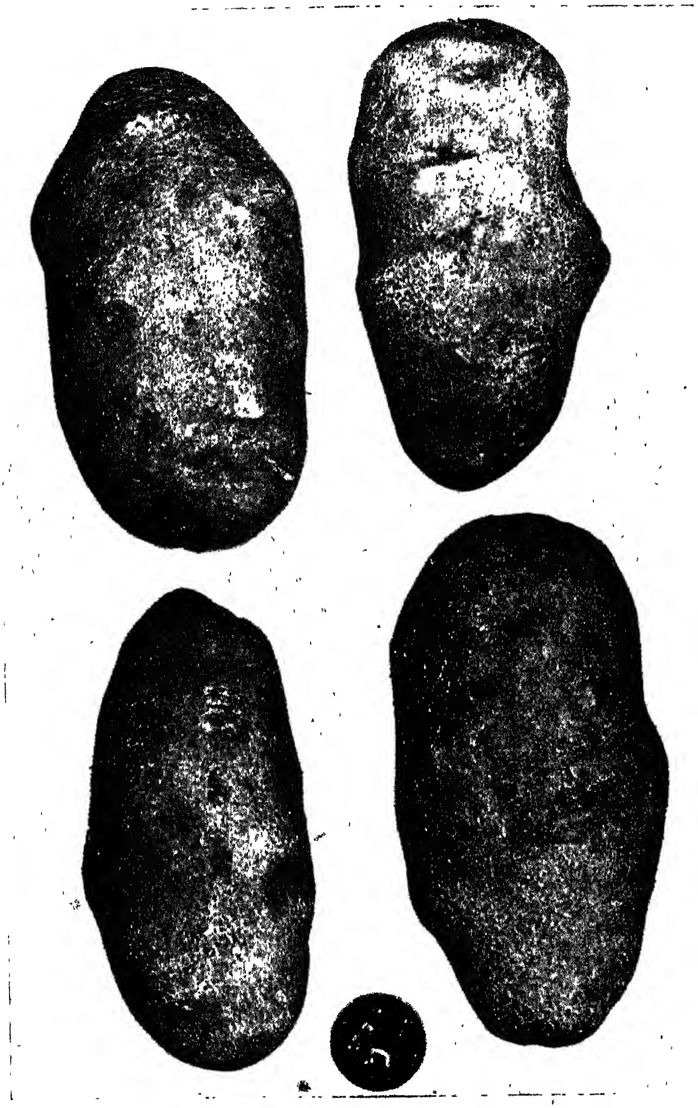
The average of the whole of the returns of each variety was as follows:—

AVERAGE Yield of Varieties of Potatoes used in the various experiments.

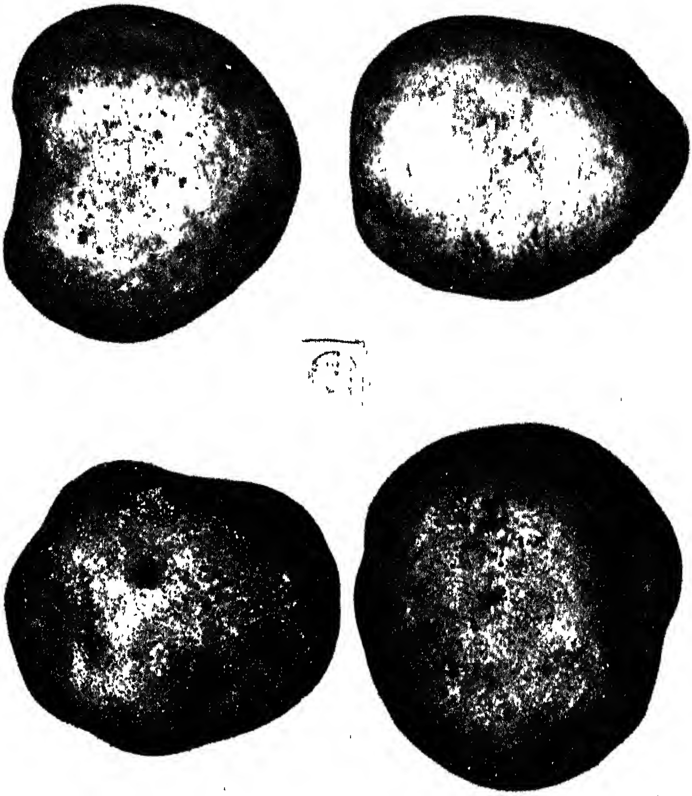
Variety.	No. of Trials.	Average Yield. Tons	cwt.	qrs.	lb.
Irvine Ruby	13	4	18	2	9
Coronation	10	4	12	2	0
Brownell's Beauty	15	4	9	3	25
Cambridge Kidney	15	4	7	3	5
Satisfaction	14	4	1	2	26
Bliss's Triumph	15	3	10	1	0
Manhattan	13	3	9	2	16
Early Rose	15	2	17	2	26

1st. *Irvine Ruby.*—This potato proved to be by far the best of the eight varieties under trial, coming first in the average with the fine yield of 4 tons 18 cwt. per acre in thirteen trials.

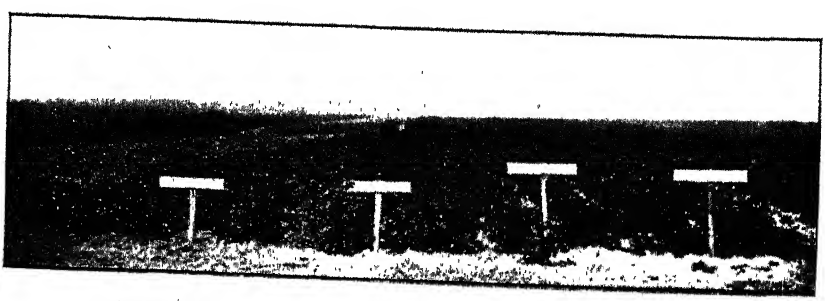
The seed was obtained from Mount Irvine, under the name "Red Ruby"; but as it was evidently not the potato generally known by growers here under that name, and as none of the authorities to whom it was submitted could say definitely what it was, it was decided to call it "Irvine Ruby." It is a fairly-quick maturing red-skin variety, a favourite on the market, a heavy cropper, usually bears a very large proportion of saleable tubers, and is a first-class cooking potato. As evidence of its heavy cropping quality, it will be noticed that it came first in yield of the eight varieties at Grafton, West Maitland, Wollongong, Dapto, Kangaroo Valley, Jindabyne, and Mudgee, and therefore gave very



Varieties of Potatoes.—Cambridge Kidney.



Varieties of Potatoes.—Satisfaction.



View of Potato Plots on Mr. J. Eisenhauer's Farm, Rosewood, Tumbarumba.

heavy crops under a variety of conditions of climate and soil; in fact, in some districts where the season proved to be a dry one, it was the only variety that made a satisfactory growth.

2nd. *Coronation.*—This is a late-maturing blue-skin variety, somewhat resembling Early Manhattan, but considerably later, and a heavier cropper. It generally yields very even, clean-grown tubers of a good marketable size, and it is claimed that it stands dry weather well.

3rd. *Brownell's Beauty.*—This old and favourably known red-skin variety again proved that it is one of the best croppers that we have. It gave good returns in nearly all districts, and yielded fine, large, clean tubers of excellent quality; in fact, it must still be regarded as one of the best market potatoes we have.

4th. *Cambridge Kidney.*—This well-known white-skin potato also cropped well in most districts, giving top yields at Tenterfield, Guyra, and Batlow. It cannot, however, be regarded as being nearly equal to the above varieties, for the reason, in the first place, that many buyers will not take a white-skin potato (in fact, there is still a strong preference for rough red-skins), and secondly, because it in most cases yields such a heavy percentage of small unmarketable tubers. This fault is specially evident if the season is dry; in fact, unless the season is a favourable one for a strong growth, this variety is almost certain to yield a large proportion of small tubers. Complaints were also received that the tubers were not of good quality, being stringy.

5th. *Satisfaction.*—This potato, which came fifth in the averages, is a red-skin variety of excellent shape, large and clean; in fact, it proved to be one of the best all-round potatoes tried. It seems to be especially well suited for the North Coast districts.

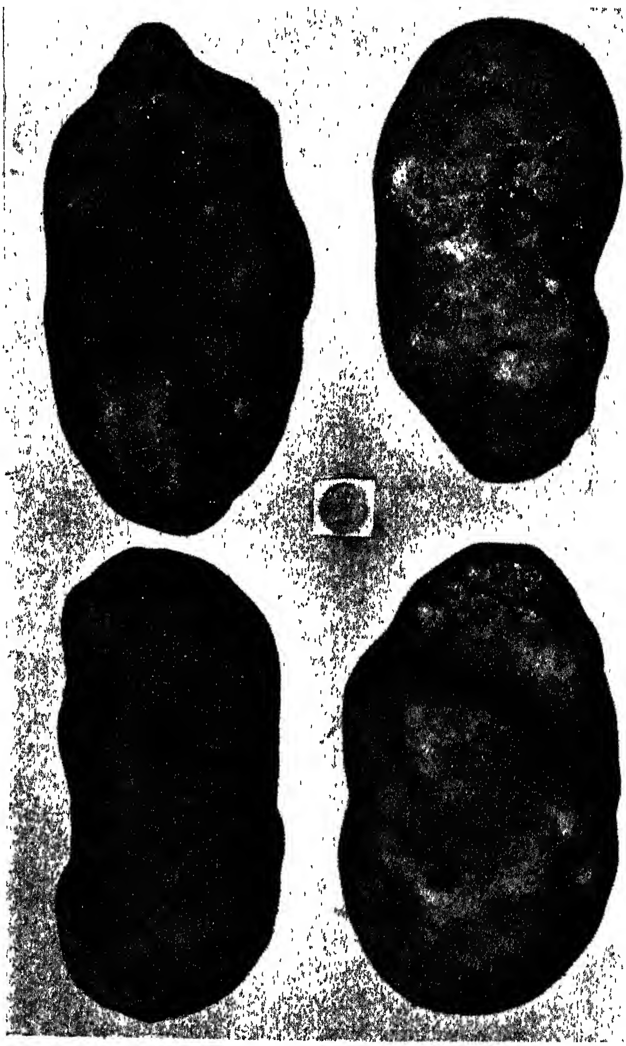
6th. *Bliss's Triumph.*—This is another well known red-skin variety .It gave good even crops; but the tubers, although of good shape and even in size, were smaller than most of the red-skins, and the crops did not weigh out as well as was expected. Its heaviest yield was at Tumbarumba.

7th. *Manhattan.*—This blue-skin potato did not compare favourably with the other blue-skin under trial, viz., Coronation, as in many of the crops there was too large a percentage of small tubers, and the large ones were uneven in shape.

8th. *Early Rose.*—For such an old and favourably known variety these trials were very disappointing; the yields were light, the tubers small, and it seemed to be less resistant to disease than any of the others.

At first sight it seems rather strange that first and second place should be filled by the two varieties obtained from one place, viz., Irvine Ruby and Coronation from Mount Irvine. This fact is, I believe, due more to the quality of the seed than to the apparent superiority of the varieties. When an inspection was made, before planting, of the whole of the seed of the eight varieties, it was at once apparent that the Irvine Ruby and Coronation potatoes were better grown samples than any of the others. The growers of

these potatoes, Messrs. C. P. Scrivener and H. B. Morley, of Mount Irvine, Blue Mountains, state that they adopt the practice of selecting fairly large and well-grown tubers for seed. These are planted whole, and wider apart than the distance growers usually plant them, viz., in drills 3 feet apart and

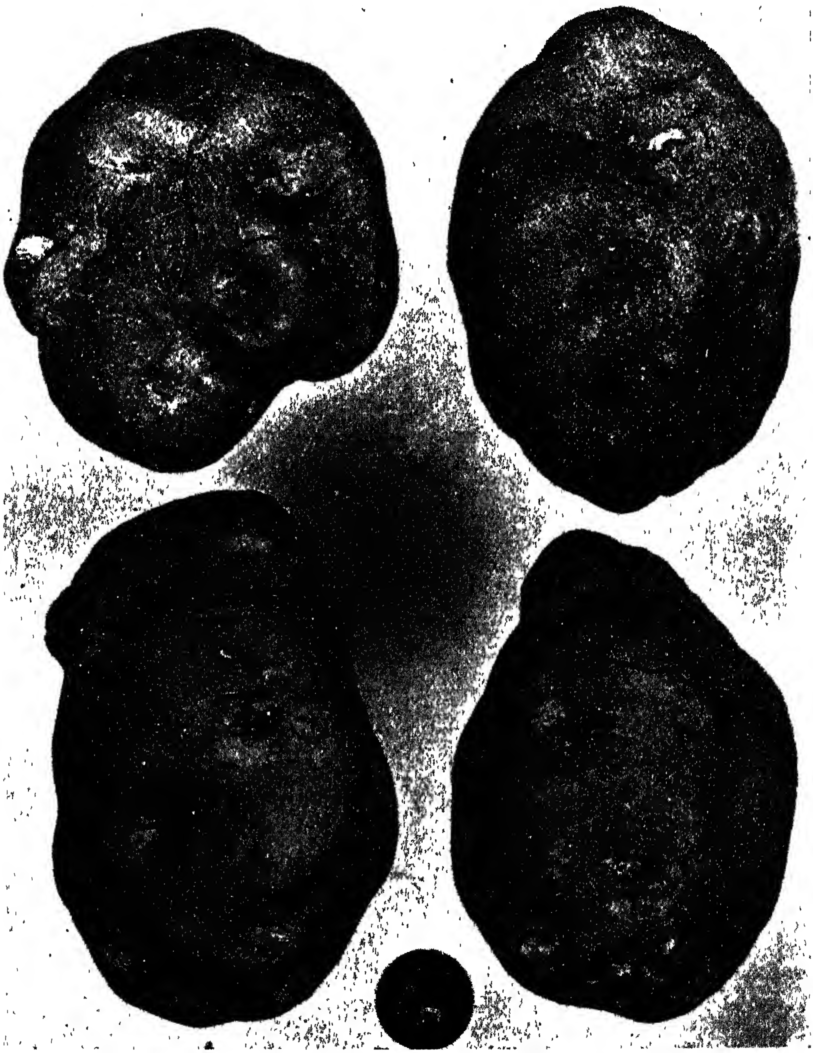


Varieties of Potatoes.—Early Rose.

2 feet apart in the drill. They claim that the method of using large tubers for seed and planting them well apart yields heavy crops of well-grown tubers. Mr. Scrivener also says :—

In keeping seed potatoes we find that, to get the best results, it is essential that the seed should be spread out in a single layer, in a well-lighted shed, so that it becomes

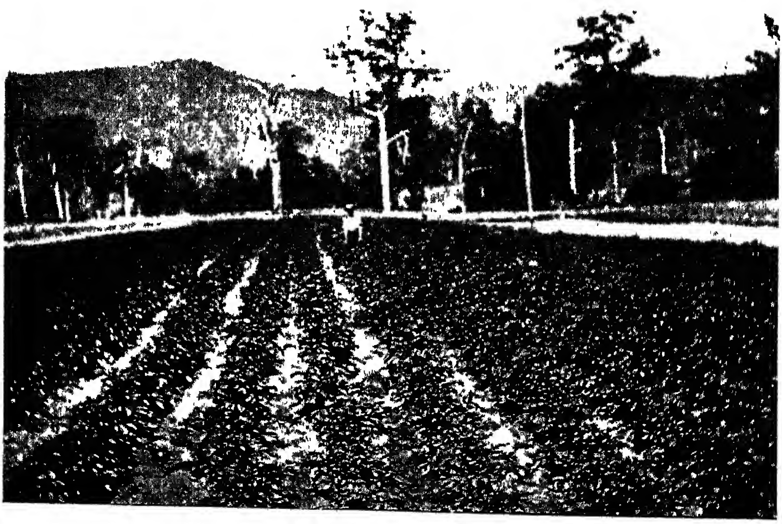
green. Treated this way the seed throws out short, strong shoots, making misses very rare; also the crop matures more quickly, and gives better returns. In this cool district we do not plant until the end of October or the beginning of November. Earlier plantings rarely do well, whereas the late planted crops have never yet failed to give good returns. Although our soil is a very rich volcanic loam, we find that it always pays to manure, and we apply 4 cwt. of complete fertiliser per acre to each potato crop.



Varieties of Potatoes.—Manhattan.

There is no doubt that this system of growing seed had much to do with the success of these two varieties, Irvine Ruby and Coronation, and it can be strongly recommended to all growers of potatoes.

Potato Plots, Mr. G. Lindsay's Farm, Dapto.



Potato Plots, Mr. J. Chittick's Farm, Kangaroo Valley.

After dipping the seed in formalin, the tubers were cut and planted out on the 30th August, 1909, in rows 2 feet 9 inches apart. The results were as follow :—

Five rows, area one-tenth acre, received a dressing of 50 lb. of bonedust. The total weight of potatoes taken from the plot was 513 lb., equal to 2 tons 5 cwt. 3 qrs. 6 lb. per acre.

Five rows, area one-tenth acre, given 50 lb. of superphosphate, yielded 527 lb., which is at the rate of 2 tons 7 cwt. 6 lb. per acre.

Two rows, area one-twenty-fifth acre, sown without manure, gave 124 lb., or at the rate of 1 ton 7 cwt. 2 qrs. 20 lb. per acre.

Potatoes were numerous under the stems, but none were of a marketable size. From the results given it is evident that for a late sown potato crop on Wollongbar red soil country the variety of potato used, viz., Magnum Bonum, is a failure, and cannot be recommended.

The experiment is to be repeated this year, but with Brownell's Beauty, which gave the largest yield in the potato trial.

Cut versus Whole Seed Experiment.

Mr. M. H. Reynolds, Inspector for the Western District, conducted an experiment with whole *versus* cut seed, with the following results :—

		Ruby.	Satisfaction	Manhattan.	Bliss's Triumph	Cambridge Kidney.	Average Yield.
		t. c. q. l.	t c. q. l.	t. c. q. l	t. c. q. l.	t. c. q. l.	t. c. q. l.
Mudgee	Cut	4 8 3 26	....	3 7 2 15	... .	4 2 2 10	3 9 2 26
	Whole	4 3 0 4	....	1 18 3 10	....	2 4 1 20	2 15 1 20
Orange	Cut	....	2 4 3 26	....	3 2 2 27	1 10 2 25	2 9 0 16
	Whole	.... . .	2 15 2 16	....	3 6 1 21	4 3 1 1	3 8 1 22

This contradictory result is further proof that no definite rule can be laid down with regard to this matter. The grower must judge for himself; if the potatoes are large they should be cut, but if on the small side they should be planted whole.

View of another portion of Mr. Eisenhauer's Potato Plots, Rosewood, Tumbarumba.

SECOND-HAND BAGS FOR MANURE.

THE Kialla branch of the Potato Growers' Association recently drew the attention of the Department of Agriculture to the possibility of Irish Blight and other diseases being spread by the use of second-hand potato bags for carrying fertilisers. The Department communicated with the leading manure dealers to ascertain whether such a practice was adopted, and as a result, the following firms have intimated that they do, or will, for the future, have all their manurial products put up in new sacks only:—

Arthur H. Hasell, 2, Bridge-street, Sydney.

Agricultural Offices of the Potash Syndicate, 7 and 9, Bridge-street, Sydney.

George Shirley (Limited), 279, George-street, Sydney.

Colonial Fertilisers Co. (Limited), 117, Pitt-street, Sydney.

A. Wooster, Ray's-road, Epping.

Messrs. Paton, Burns & Co., of 123, Sussex-street, Sydney, never use bags which have previously carried root crops.

The Department will be pleased to publish in this *Gazette* the names of any other manure merchants who will give an honourable undertaking that they will not put up their manurial products in second-hand bags, as if such a practice were adopted (which apparently it is not), the difficulty of controlling Irish Blight and similar diseases would be greatly increased.

LUCERNE AT BOGGABRI.

A POPULAR opinion in this State is that only rich alluvial river flats are suitable for the growth of lucerne. We are always pleased to drive a nail into the coffin of that idea, and we hope eventually to bury it without ceremony.

The Hon. R. J. Black, M.L.C., brought the Department another nail recently, in the shape of a bundle of lucerne, grown on friable red wheat land on Booroomin Estate, Boggabri, 3 miles from the river. It was planted on virgin soil on 6th March, 1910, and is now (middle of August) most thick and luxuriant. The specimens produced contained stems 2 feet 6 inches in length. The rainfall is 24 inches, and there are thousands of acres of similar land in the district.

Mr. Black's method of sowing was to plough and harrow the land in the ordinary way as for wheat, and drill in 6 lb. seed per acre, afterwards harrowing to cover the seed.

A paddock alongside of the property was sown with lucerne during the drought year, 1902, and is being repeatedly cut for hay. This induced Mr. Black to give lucerne a trial.

Export of Apples and Pears from Bathurst Experiment Farm.

W. J. ALLEN.

THIS season two trial shipments of apples and pears from Bathurst orchard were made to London, per s.s. "Malwa," on 24th February, and s.s. "Orontes," on 2nd March. The "Malwa" shipment included 187 cases of apples from the Farm, and three cases of pears; also twelve cases of apples and four cases of pears, supplied by Mr. C. C. Tucker, of Sydney. The "Orontes" carried 197 cases of Bathurst Farm apples and three cases of pears, as well as twelve cases of apples for Colonel H. B. Lassetter. Two cases of apples from this shipment were presented to Sir Harry Rawson.

The Department's fruit was consigned to the Agent-General, who was requested to dispose of it to the best advantage. Mr. Coghlan placed the fruit in the hands of Messrs. Keeling and Hunt, of Monument Square, London, E.C., and has now furnished reports from that firm upon the two shipments.

The apples from Bathurst Farm, per s.s. "Malwa," consisted of the following varieties:—

Jonathan, 76 cases.	Cleopatra, 15 cases.
Rome Beauty, 20 cases.	Five Crown, 76 cases.

In addition there were three cases of Idaho pears.

The "Orontes" carried the following varieties of apples from Bathurst:—

Jonathan, 50 cases.	Cleopatra, 8 cases.
Five Crown, 40 cases.	Esopus Spitzenberg, 3 cases.
Monroe's Favourite, 50 cases.	Margil, 2 cases.
Rome Beauty, 30 cases.	Ben Davis, 2 cases;
Granny Smith, 8 cases.	

and one case each of Adam's Pearmain, Buncombe, Pomme de Neige and Scarlet Queen. In addition there were three cases of Packham's Triumph pears.

Messrs. Keeling and Hunt report that in the "Malwa" shipment the apples were of fair quality only. The selected Jonathans were rather too small, and not sufficiently coloured, but the Rome Beauties and Cleopatras were quite good.

The firm's report on the Five Crown Pippins in this shipment is not commendatory. But we have never considered the Bathurst district suitable for the Five Crown, as this variety usually does best in higher and colder districts, where they not only crop well, but have proven to be good keepers, take on a beautiful waxy colour, and are suitable for dessert and cooking. Messrs.

Keeling and Hunt recommend that shippers should send only those apples which carry well, and are as showy as possible, as fruit is very largely bought for decorative purposes in London.

One case of pears was sound and of fair quality, but the other two cases were absolutely bad. There is quite ten times more risk in sending pears than apples, and Messrs, Keeling and Hunt are pessimistic about results from shipping this class of fruit.

The consignment ex "Orontes" was better. The Five Crown Pippins arrived in better condition in this shipment than did those per s.s. "Malwa"; the Monroe's Favourites were of good quality; and the Rome Beauties and Cleopatras very good indeed. The "extra choice" Rome Beauties were especially fine, and the two boxes of Cleopatras marked "specially selected" contained particularly fine fruit. The Granny Smiths were good, but Messrs. Keeling and Hunt state they will never be so popular as the others.

Adam's Pearmain was a very nice apple, though it might have been brighter, and should sell well. Scarlet Queen was a very pretty apple, rather soft; but some of the fruit was frozen and dark-brown inside. Pomme de Neige was of fair quality, clean and bright. Margil was a small apple, nicely coloured; but Esopus Spitzenberg, Ben Davis, and Buncombe were more or less dull, and would never sell particularly well.

The highest prices were obtained for Cleopatra, Rome Beauty, Jonathan, Monroe's Favourite, Five Crown, and Granny Smith. In my opinion the Granny Smiths were packed a little too early to be in their best condition. They require to be kept a little longer, both on the trees and in store, before being put on the market. For this State, generally speaking, the six varieties named are the best which have been tested so far, and in districts which suit them they are recommended to be grown.

The pears ex "Orontes" were again a total failure, though it was obvious that the fruit had been handsome, and would have realised a lot of money if it had arrived in a sound condition. The packing of the apples was very good, the wood of the cases being clean and excellent; but pears, if shipped, should be packed in trays (two cleated together to form a package). Each tray should contain about 15 lb. of fruit. Each pear should be wrapped separately in paper, and plenty of wood-wool should be used.

The following statements show gross and net returns for the two shipments, together with London prices realised per case for the several varieties:

APPLES and Pears (190 cases), ex "Malwa," 13th April, 1910.

	£	s.	d.	£	s.	d.
By London A/c Sales				84	1	9
DEBITS.	£	s.	d.			
To London charges	7	10	5			
,, Rail freight, Bathurst to Sydney	2	12	0			
,, Cartage, Darling Harbour to Wharf	0	15	0			
,, Freight, Sydney to London	27	2	3			
,, Bill of Lading, &c.	0	2	0			
,, Cases, wrapping and packing	11	17	6			
				49	19	2
				£34	2	7

NOTE.—The net price realised is 3s. $7\frac{2}{16}$d. loose in packing-house, Bathurst orchard. Two cases of pears were landed in bad condition, and were valueless. Four cases of apples were broken, and realised only 4s. per case. These apples did not land in an attractive condition.

	s.	d.	
Cleopatra averaged	12	6	per case
Rome Beauty averaged	10	$7\frac{2}{3}$	,,
Jonathan averaged	9	$10\frac{1}{2}$	,,
Five Crown averaged	7	$4\frac{1}{2}$	,,

APPLES and Pears (200 cases), ex "Orontes," 20th April, 1910.

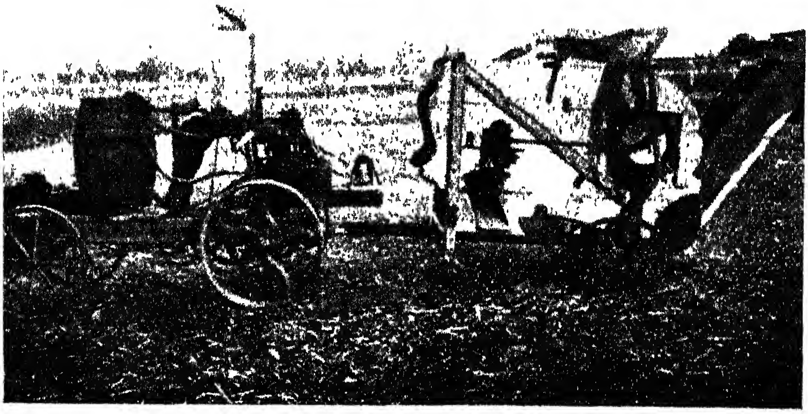
	£	s.	d.	£	s.	d.
By London A/c Sales				100	3	3
DEBITS.						
To London charges	8	9	3			
,, Rail freight, Bathurst to Sydney	2	12	0			
,, Cartage, Darling Harbour to Wharf	0	15	0			
,, Steamer freight, Sydney to London	26	5	0			
,, B/L and export forms	0	2	3			
,, Cases, wrapping and packing, at 1s. 3d. per case ...	11	17	6			
				50	1	0
				£50	2	3

NOTE.—The net price realised is 5s. per case at Bathurst, delivered loose in packing-house. Three cases of pears landed in bad condition, and realised only 2s. 3d. per case. Seven cases of apples were landed slack, and realised 4s. per case. The following is the average price of each variety :—

	s.	d.	
Cleopatra averaged	13	0	per case.
Rome Beauty averaged	10	8	,,
Jonathan averaged	10	$5\frac{5}{8}$	,,
Monroe's Favourite	10	$0\frac{1}{4}$	,,
Five Crown averaged	9	$10\frac{1}{2}$	,,
Granny Smith	9	$6\frac{1}{4}$	,,
Esopus Spitzenberg	8	3	,,
Margil (2 cases only)	12	0	,,
Ben Davis (2 cases only)	8	0	,,
Scarlet Queen (1 case only)	11	0	
Adams' Pearmain (1 case only)	10	6	
Pomme de Neige (1 case only)	10	6	
Buncombe (1 case only)	7	0	

SPECIMENS OF FRUIT FROM NEWCASTLE.

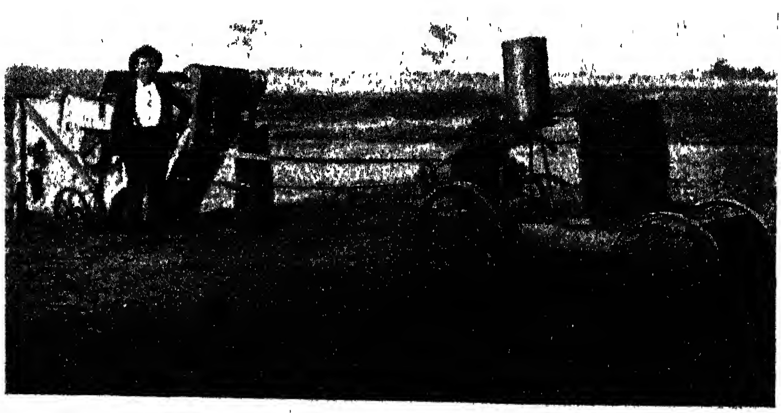
MR. A. BARRETT, of Cardiff, Newcastle, has supplied Mr. W. J. Allen, Fruit Expert of the Department, with specimens of oranges (Washington Navel, Joppa, and Late Valencia), mandarins (Thorny, Emperor, and Beauty of Glen Retreat), lemon (Villa Franca), and shaddock. The fruit, which was grown by Mr. Barrett, was free from disease and very fine, with the exception of the lemon, which was on the large and coarse side.



An Improvised Traction Engine.

An Improvised Traction Engine.

Mr. Geo. Wiburd, Assistant Forester, Corowa, has supplied the accompanying photographs of a traction engine constructed by Mr. A. Gusket, a farmer of the district, with a $3\frac{1}{2}$ horse-power Ferro engine, and waste wheels and timber of other worn-out machinery. It is claimed that the engine can haul a winnower, and even pull a single-furrow plough, and can attain a speed of between 5 and 7 miles an hour on the road; it is also used to drive a saw for cutting wood, as well as for pumping water—in fact, Mr. Gusket says he could scarcely do without it.



Driving a Winnower.

Some Observations on Bunt and Fungicides.

G. P. DARNELL-SMITH, B.Sc. (Lond.), F.I.C, F.C.S.,
Assistant Microbiologist, Bureau of Microbiology.

At the instance of the Wheat Experimentalist, Mr. George L. Sutton, who supplied the necessary materials, a series of observations was made upon the disease of wheat known as bunt. The work on this subject was conducted at the Milson Island Experiment Station.

The species of bunt with which these observations are concerned, and which appear to be those most commonly met with in New South Wales, are *Tilletia tritici* (*T. caries*) and *Tilletia levis* (*T. fœtans*). The spores of the former are large, and covered with reticulate thickenings; the spores of the latter are considerably smaller, and comparatively smooth; but the development of both is similar, and that of *Tilletia caries* (bunt, stink brand; or stinking smut of wheat) may be taken as typical.

In their germination the spores exhibit four stages, namely:—

1. The spore sends out a delicate germ tube or promycelium.
2. A whorl of thread-like branches (conidia), generally eight in number, are produced at the end of the germ tube.
3. The thread-like branches unite in pairs by development of a short transverse tube between each pair.
4. From one or other of the paired branches a short, sickle-shaped sac (tertiary spore) arises, and from this a thread-like hypha, which penetrates the wheat grain.

The various stages are well shown in Fig. 1, taken from Tubeuf's "Diseases of Plants."

The observations upon bunt in this laboratory were carried out on spores actually growing upon wheat grains; *Tilletia caries* and *Tilletia levis* being kept under observation upon grains of Comeback, Bobs, and Federation wheat.

When the grains were artificially infected by agitating them with bunt spores in a small box, the spores were found to adhere chiefly to the brush upon the grain at the opposite end to the embryo, which situation affords ideal conditions for their development. Bunt spores will germinate in water, and produce there very long promycelia, which, however, only give rise to the further (conidial) stage in air.

If a wheat grain be dropped into water it will be observed that it carries down with it a certain amount of air entangled in the tuft of hairs at its end, and also in the groove at one side of the grain. The closely-packed hairs, in fact, entangle the air to such an extent that it is almost impossible for it to escape. On removing the grain from the water the brush end will

be found to be comparatively dry. A coating of air would be maintained at this spot much more easily in the damp earth in which wheat germinates than in water itself; hence, under natural conditions, any bunt spores entangled in the brush are certain of enough air to product their conidia. A portion of the brush of hairs with the spores attached is shown in the accompanying photograph. (Fig. 3.)

When germinating in water, bunt spores produce long promycelia (*see* Fig. 1), but when germinating on wheat grains they form an exceedingly short germ tube, upon which conidia appear about the fifth to seventh day after planting. The conidia join in pairs, and produce tertiary spores (called by Tubeuf "secondary conidia"), which in turn send out delicate hyphæ, which penetrate the grain. It is to be noted that the seed-coat of the grain of wheat is weakest at the brush end; that the hard starch of the grain has become largely converted into sugar or a gelatinous condition about

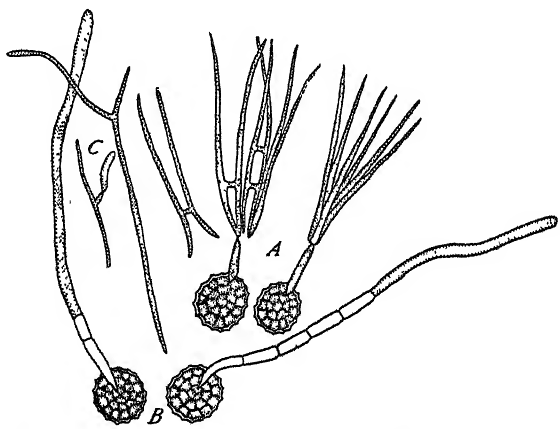


Fig. 1.—Showing stages of development of *Tilletia caries*. (After Tubeuf.)

A.—Two spores germinated in moist air; a short promycelium is developed, and bears a crown of conidia (secondary spores) several of which have fused in pairs. Fusion of conidia, germination, and development of a secondary conidium (tertiary spore), C, are also shown.

B.—Two spores germinated in water, with promycelia which elongate till the water surface is reached, where they form conidia; the promycelia are septate, and the plasma passes over into the younger cells.

seven days after planting; and that by this time the grain has swollen, rupturing the seed-coat at its weakest point, where the ragged ends of it may be observed. The delicate hyphæ produced by the tertiary spores penetrate into this weak spot, and once inside the grain, absorb the nutriment that lies all round them, growing quickly.

In the growth of the fungus it is to be observed that the protoplasm passes over from the spore to the promycelium, and subsequently from the older cells of this to the younger ones, near the apex. This same power of continuously passing the protoplasm, or living substance, forward to the active cells at the apex, is observed in the hyphæ in their progress through the wheat grain. They were traced into the young plumule, and doubtless

this power enables them to travel up the entire length of the wheat-stalk, producing at length their crop of spores—an evil-smelling mass—in the ovaries of the wheat, which are completely destroyed, except the outer coats.

From these data the life cycle of the fungus may be briefly indicated as follows:—Bunt spore (primary) ⟶ promycelium ⟶ eight conidia (secondary spores) which join in pairs ⟶ four tertiary spores ⟶ hyphæ which ramify through the wheat plant and again produce primary spores in the ovaries of the host.

By no means all the bunt spores upon a wheat-grain germinate, but this is compensated by the fact that each spore that does germinate produces four tertiary spores. The fact that the wheat-grain is not easily wetted at the brush-end, where the bunt spores become chiefly attached (*see* Fig. 1), renders the disinfection of wheat by soaking it in fungicides more difficult than it otherwise would be, and may account for the "reinfection" of the seeds. Jensen's hot-water treatment, by causing the air to expand, and so escape, may have certain advantages in this respect. The treating of grain with any liquid, however, renders it "messy," and more difficult to deal with than dry grain. For this reason, and for the purpose of reaching the spores in the brush, there would seem to be an opening here for the application of a gaseous germicide, but the point is one which I have not yet found time to investigate.

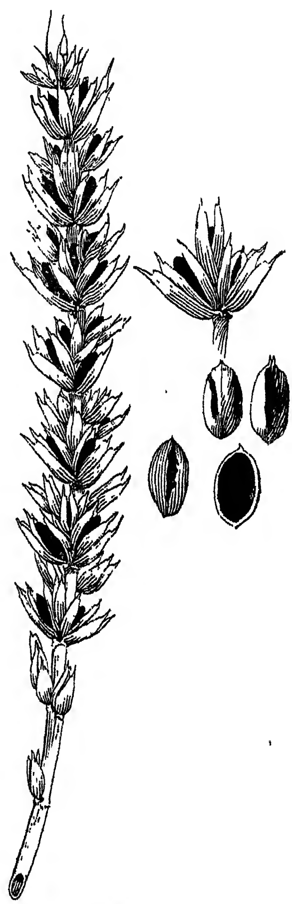


Fig. 2.

Tilletia caries. Ear of wheat with smut grains indicated black. The isolated spikelet contains two smut grains, which, as well as the isolated examples, show fissures in the original ovary wall. One smut grain in section shows the interior filled with black spores, but the ovary wall still intact. (After Tuneuf.)

Certain varieties of wheat have the reputation of being bunt-resistant.

Observations on this point were made by comparing the behaviour of three resistant varieties—Cedar, Florence, and Medeah—with that of three liable varieties—Comeback, Federation, and Bobs—in the presence of bunt. In one experiment six boxes were sown with the wheats, twelve seeds in each box, six infected, six non-infected; the infected seeds being planted 7 inches away from the uninfected seeds. The seeds were infected with *Tilletia levis.* Every ear of the bunt-liable varieties became diseased, but the bunt-resistant varieties all remained sound, as did all the uninfected plants. The experiment was repeated, the grains being this time infected with *Tilletia tritici*, and precisely similar results were obtained; so that, clearly, certain wheats have properties which render them

immune from bunt attacks. The observations I was able to make did not afford a final explanation of this immunity. Nevertheless, it is the case that the resistant varieties—Cedar, Florence, and Medeah—have comparatively little brush, and so do not pick up spores easily. Moreover, their endosperm is very horny. As regards power of germination and rate of growth, they do not appear to sensibly differ from the susceptible varieties. Thus, while the existence of the immunity could be demonstrated, the explanation of it for the time being was not forthcoming.

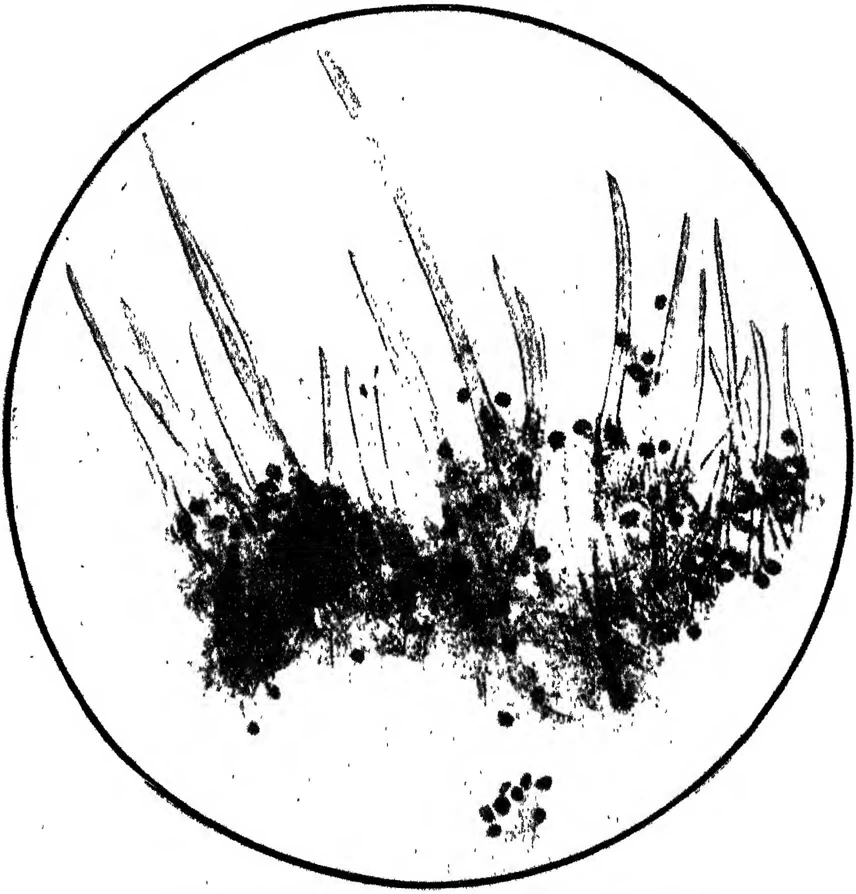


Fig. 3.—Showing a small portion of the brush of a grain of wheat infected with bunt spores. [Magnified.]

Like most fungus spores, those of bunt appear to require special circumstances for their favourable growth, and unless the necessary conditions supervene, they may fail to grow at all. In Europe, the fungus is reported to attack spring wheat more than winter wheat; in this laboratory, spores which grew vigorously upon wheat-grains in August, failed to grow under

similar conditions six months later; while infected wheat-grains which were sown in virgin soil were attacked, but infected wheat-grains sown in heavily-manured soil remained immune. The secondary spores, or conidia, produced by the bunt spores upon germination, are much more delicate and susceptible than the bunt spores themselves. It has been shown above that they are always produced outside the wheat-grain, and it is quite conceivable that changes in the environment which would be without effect upon the primary spores, might operate adversely on the secondary spores produced from them.

For the application of fungicides to wheat it is recommended that the grain be placed in various steeps. As long ago as 1858, Kuhn advised soaking in a solution of copper sulphate, and this method is still followed; but in more recent years the seed has received a subsequent bath in milk of lime, or lime-water. A solution of formalin has also come into use. For the same purpose Jensen has advised a method of soaking the seeds in water assumed to be of such a temperature that, whilst killing the spores clinging to the outside, the heating will not be great enough to injure the embryo of the wheat within the testa. For the time being this last-mentioned method was passed over, and attention devoted to the effect of the chemical fungicides. To test their action, wheats treated and untreated were compared as regards their germinating power upon porous tiles kept moist on blotting-paper. The following results of one such experiment may be regarded as typical of the issues on this point:—

Comeback Wheat.	Treatment.	No. of Seeds.	No germinating after—				Total.
			24 hours.	72 hours.	96 hours.	144 hours.	
Not infected ...	Not treated	30	28	28	28	28	28
Infected	Formalin	30	21	25	26	27	27
Infected	Copper sulphate and lime	30	28	29	29	30	30
Infected	Copper sulphate only ...	30	6	12	17	19	19

From these data it will be observed that there is very little difference between the untreated grains and those treated with formalin or with copper sulphate, followed by lime. Nearly all had started to germinate within forty-eight hours, and any grains which had not germinated then were for the most part still quiescent at the end of 144 hours. With those grains treated with copper sulphate only, however, germination was considerably affected. Out of thirty seeds, six had germinated in forty-eight hours; six more in seventy-two hours; five more in ninety-six hours; and two more in 144 hours. Thus at the end of 144 hours, only nineteen out of the thirty seeds had germinated, and these were not vigorous. Hence a 2 per cent. solution of copper sulphate may either cripple or kill the seed, and considering the great necessity for a young plant to be vigorous, and to establish itself firmly in the soil from the very commencement of its growth, the use of copper sulphate alone cannot be recommended. Subsequent treatment with

lime prevents its deleterious effects upon germination. Formalin, which is generally supposed to harden the seed-coat, does not appear from this table (and others) to greatly hinder germination.

S. U. Pickering (Eleventh Report of the Woburn Experimental Fruit Farm) has recently investigated the copper fungicides, more particularly Bordeaux mixture.

The reaction between copper sulphate and lime was shown to yield four basic sulphates and two other compounds of copper oxide and lime. The properties of the sulphates were studied, and, in particular, their decomposition under the influence of water and carbonic acid in presence of calcium sulphate or of organic matter, these being the conditions obtaining on the leaf-surface when the Bordeaux mixture is used as a spray. They would also obtain in the soil.

The basic sulphates are insoluble, and have to be converted into a soluble substance before they can exert a fungicidal action. No evidence could be obtained that the plant leaf or the spore excreted anything that would dissolve the insoluble substance, but it was shown that the carbonic acid of the air decomposed these basic sulphates, setting free the soluble copper sulphate. The copper sulphate thus liberated constitutes the active part of the mixture. It acts in two ways. It directly poisons the fungus cell developing from the spore; and some of it gets into the leaf, displacing a certain amount of iron, and entering into a remarkable combination, not yet investigated, which seems, so long as it persists, to afford the leaf immunity against fungal attacks.

The protection from bunt conferred by basic copper sulphate upon wheat grains treated with copper sulphate followed by lime doubtless acts in a similar manner. The copper sulphate set free by the action of the carbonic acid in the earth poisons the germinating bunt spores, and possibly enters into combination with the wheat-grain, thereby conferring immunity from fungal attack. The object of the fungicide is to furnish a steady supply of normal copper sulphate, which, used alone, is too soluble, and too virulent.

Pickering has shown that the precipitate obtained when *Bordeaux mixture* is prepared by following the ordinary recipe (when excess of lime is added) is not so efficacious as a fungicide as that which may be produced by a slightly different procedure.*

If one uses lime water (a solution of lime in water) in place of the milk of lime (a suspension of lime in water) a precipitate is obtained which is said to be about twelve times more efficient and much speedier in its action than the precipitate obtained when Bordeaux mixture is prepared in the ordinary way.

The effects of the fungicides, as above described, are clearly illustrated by the accompanying photographs, the attached legends sufficiently indicating the conditions represented in each case.

* The change in the method of preparing Bordeaux Mixture, suggested by Mr. Pickering, is being investigated by the Department of Agriculture.—ED.

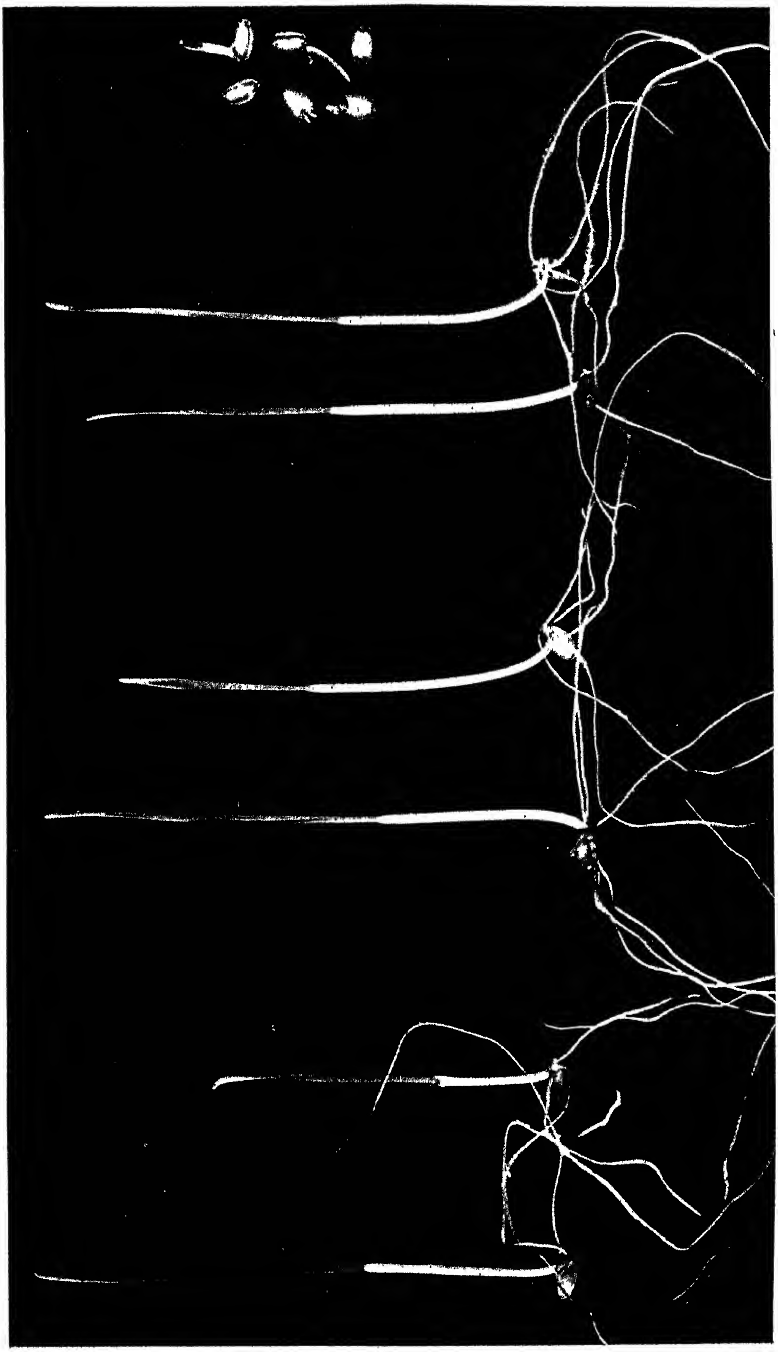
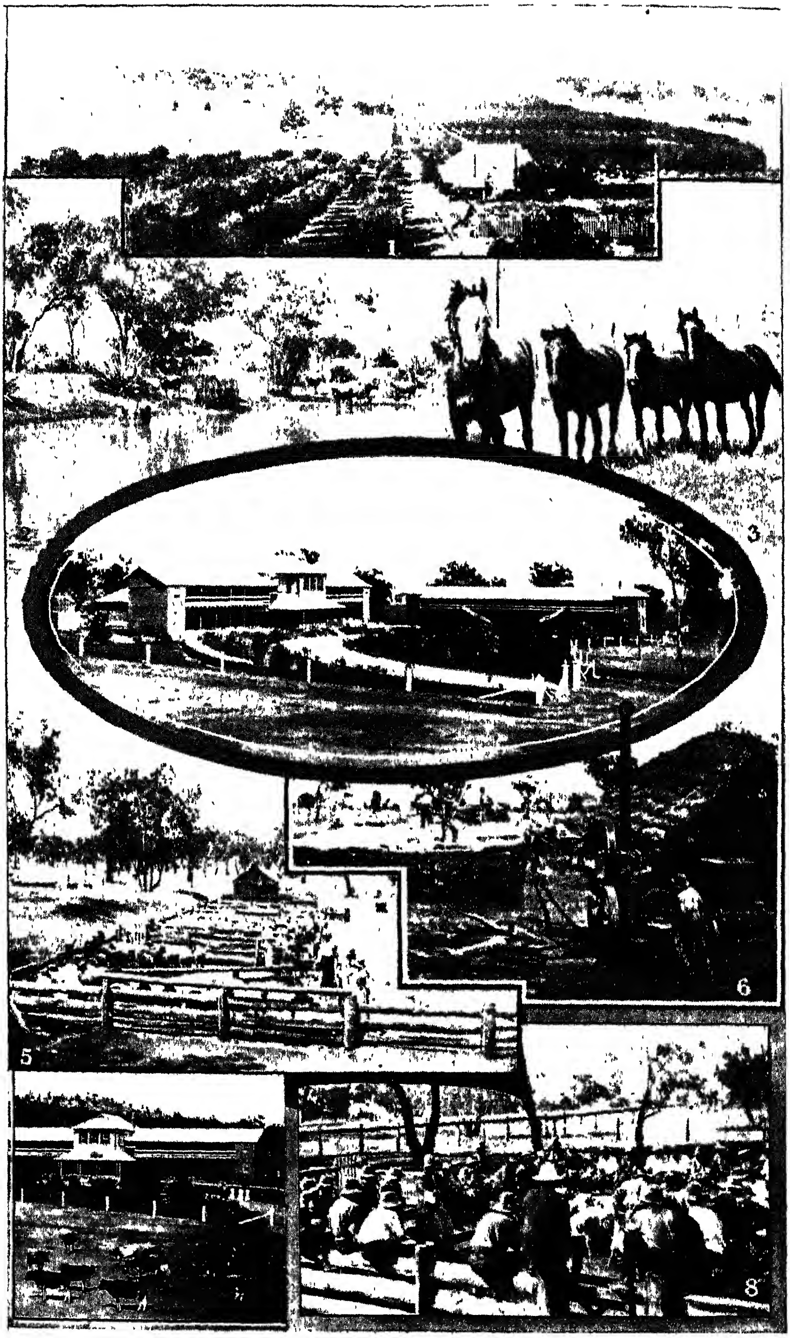


Fig. 4.—Showing comparative growth of wheat grains, seven days after sowing seed treated and untreated.



Wagga Experiment Farm.

Our Experiment Farms.

J. E. O'GRADY.

WAGGA.

Manager—G. M. McKeown.
Registrar—J. T. McKern.
Orchardist—S. A. Hogg.
House Master—C. C. Crane, B.A.
Experimentalist—R. W. McDiarmid.
Dairy Instructor—W. G. A. Lee.
Poultryman—A. L. Wyndham.
Farm Foreman—A. Fuller.

THE first half of this year was unusually dry in the Wagga district, and the native pastures presented the dull grey tint of the western plains in summer. But the plough turned up the red soil fresh, sweet, and wholesome. It was the lifting of the curtain from a scene of riches and beauty, for in that red granite soil more than in the rainfall, lies the wealth of Riverina. We are inclined to calculate too much upon sufficiency of rainfall in our estimates of the possibilities of wheat-growing in New South Wales. The results of the past few seasons at Wagga Farm point the way to a modification of our opinions, as some of the leading varieties of wheat have indicated their preference for lesser annual rainfall than was previously deemed to be necessary for maximum results. This is due to improved methods, including the use of superphosphate and more thorough soil preparation, more seasonable sowing, and the evolution of drought-resisting varieties; and it marks a step in the most important line of agricultural progress in this State—the westward march of wheat.

It would be impossible within the limits of one article to deal in any way exhaustively with the various sections into which the work at Wagga Farm is divided, and the extent to which the operations have influenced the opinions and practice of Riverina farmers. It is hoped that a brief summary of the principal lines, with a few notes upon the lessons taught by the results, will be of some interest to farmers inside and outside of this prosperous and advancing district, in addition to giving readers a general idea of the value of the institution to the State.

EXPLANATION OF PLATE.

1. View of Orchard and Cannery.
2. One of the Dams on the Farm.
3. Some of the Draught Stock bred on the Farm.
4. Students' Quarters and Offices.
5. Dipping Sheep.
6. Threshing on the Farm.
7. Some of the Jersey Herd.
8. A practical Demonstration in Sheep-classing.

The Farm.

The Wagga Experiment Farm was established seventeen years ago, and comprises an area of 3,228 acres, about 5 miles from the town of Wagga. Some 1,200 acres are utilised for cropping as a mixed farm, 95 acres for fruit culture, and the balance for grazing purposes. About 65 acres are allotted for experimental work with wheat and other cereals, fodders, and vegetables.

There is accommodation for 53 students, which is fully availed of, and the students are instructed in the principles of agriculture and horticulture, field operations, the management of stock, orchard work and fruit-drying, and the theory and practice of agriculture generally.

During the past thirteen years the annual rainfall recorded at the Farm has averaged 16·49 inches. The Wagga record for twenty-five years is 22 inches. No system of irrigation is adopted, and all crops, fruit, and stock, are dependent on surface catchment.

The stock at present on the Farm include 82 head of horses, 125 head of dairy cattle, 1,610 sheep, 69 pigs, 225 fowls, and 89 turkeys.

A special feature of the management is the system of book-keeping, under which the most minute details of costs and returns are recorded. This intricate and laborious work is, of course, not suggested to farmers, but its value on a large Experiment Farm is obvious, as a demonstration or experiment loses much of its significance without a knowledge of the cost.

The operations are designed to give practical instruction and demonstration in the best methods within the reach of the average farmer of the district; and with this end in view, appliances and machinery have been kept to the standard of economy reasonably attainable by those whose capital has to be replenished by the fruits of their labour. For instance, the shearing shed is fitted up each year in a building which is used during the remainder of the year for other purposes. This avoids the maintenance of an expensive permanent establishment; and moreover, the fitting up of the yards, &c., is an annual lesson to the students.

In addition to information sown broadcast on special occasions, the farmers of the surrounding district make frequent inquiries of the Farm, personally, by telephone, or by letter, and Wagga Farm is regarded as a common asset of those who earn their subsistence from the soil.

Wheat for Grain.

This is, of course, a strong feature in an Experiment Farm in Riverina. The red clayey loam is the best wheat land, the black alluvial river flats having a tendency to produce a heavy growth of straw and flag. Straw grown under such conditions is inferior for hay to that grown on the uplands, which mostly consist of red loam, in some places overlain by decomposed granite. On some of the lowlands above the river flats there is also a greyish loam of light texture which in some seasons produces fair crops of wheat, but is generally unreliable unless specially manured. A fertiliser containing about 20 per cent. phosphoric acid, a small percentage of sulphate of ammonia, and 10 per cent. of sulphate of potash, is recommended for this soil.

The red soil sets very hard in dry weather, and when covered with grass and the stubble of last year's crop, ploughing is a problem which one might easily be pardoned for postponing until rain comes. But rain does not always come when it is wanted in Riverina. The rainfall at the Farm this year from the beginning of January to the end of May was $5\frac{3}{4}$ inches. The secret of success under such conditions has been the disc plough, which slices and pulverises the soil when the mouldboard implement is practically useless. A spare bracket and disc are provided for the ploughs at Wagga, and these are added to reduce the width of the cuts in hard, dry ground, a practice which is strongly recommended to farmers.

Rolling prior to sowing is found to be preferable to rolling immediately afterwards, except in very dry sowing seasons, when the soil needs to be compacted around the seed, and there is less risk of crusting the surface by the compression. A second rolling will be found profitable under these conditions. If the soil is too moist at sowing time, rolling is left until the crop is fairly grown, when the support afforded the roller by the crop prevents compaction of the surface.

Manure is invariably used at the Farm in growing wheat. As the result of comparative trials, the ordinary superphosphate, containing 17 to 20 per cent. of phosphoric acid, applied at the rate of about 56 lb. per acre, is found to give the best results. Larger quantities have been tried, but were not found as profitable. In all probability the quantity will have to be increased in due course, and perhaps other ingredients of plant-food added. Potash will very likely be the next ingredient required. Commercial nitrogen has been found worse than useless, as it injured the crop. Superphosphate at the rate of 56 lb. per acre is therefore recommended for wheat-growing for grain in this district. Hay will be dealt with later.

An important factor in combating rust is the use of early maturing varieties of wheat, and the Farm officers find that manured crops ripen at least a fortnight earlier than those not so treated. Since the use of manures became extensive in Riverina the losses from rust have been nominal, and the Manager looks upon this as more than a coincidence.

The advantage of using graded seed is impressed upon all inquirers at Wagga Farm. If half a bushel of graded seed costs 3s. as against 2s. for fair average quality, and the result is an increased yield of 2 bushels per acre, the profit is obvious. Moreover, the elimination of weak and cracked grains reduces the quantity of seed per acre required. From 30 to 40 lb. of graded seed per acre is used on the Farm, according to size of grain. The aim is to sow the same number of seeds, though of course the stooling properties of the variety have to be considered. Bobs, for example, requires nearly double the quantity of seed advised for other varieties with better tillering properties.

Federation wheat has given the best average yields at Wagga Farm over a series of years. Satisfactory results have also been obtained from Marshall's No. 3, and from Zealand, the last-named having improved its

yielding qualities during the past few years. Bunyip, Comeback, and Firbank are undergoing trial on large areas, but the experience at Wagga has not been so extensive with these as with the other varieties named.

The record crops at the Farm have been grown with a 19-inch rainfall, while when it reached 26 inches the lowest yields resulted, and even sedges were found in crops sown on lower ground. In extending the wheat-growing area to the west towards the plains there is of course some risk, and intending growers are advised to await the results of careful experimental work in the doubtful areas.

At present the Department would not recommend districts in which the rainfall is likely to frequently fall below 15 inches, with seasonable distribution for wheat culture. When the rainfall between 1st May and the middle of November has fallen below 10 inches, the crops have been considerably reduced; and without seasonable rains in September and October amounting to about 4 inches, the chances of success in most seasons are not hopeful. At that period the grain is forming, and the plants require more moisture, as apart from increased growth, increased evaporation due to higher temperatures has to be met.

These remarks will give an idea of the principles adopted in growing wheat for grain at Wagga Farm—all the result of careful experimental tests. Their application on the larger scale is an education to the students and a demonstration to the farmers of the district of the advantage of the methods recommended. Last year the cost of producing 480 acres of crops was £1,280, the value of the produce being £3,080.

Wheat for Hay.

A long row of neatly thatched haystacks is a subject which appeals alike to the artist and to the economist—a subject suggesting the productiveness of the soil and man's conservation of the surplus yields from the time of plenty. There is a very long row in one of the Wagga Farm paddocks at the present time, the hay reserve comprising nearly 800 tons. The growing of wheaten hay for market is a profitable branch of farm operations in Riverina, and the methods adopted at the Farm—again the result of careful trials—should prove interesting and instructive. The hay product of Riverina is considered by city and other consumers to be superior to that grown in moister climates, the latter being more spongy and flaggy. The colour of Riverina hay is also brighter and the produce generally more marketable.

A common practice is to cut for hay the headlands of crops grown for grain. This results very frequently in inferior quality, with no chance of competition with selected hay varieties. An approved variety should be selected and grown for hay alone. Preference should be given to a white variety, carrying the green colour as low as possible on the stem, and free from the tendency to make dead flag—the last-named being one of the weak points of the old Purple Straw varieties.

Experience at Wagga Farm points to Zealand as the heaviest cropper, producing hay of the best quality, both as to palatability and colour. White Essex and White Lammas are also useful varieties. Firbank, a new variety, one of the parents of which is Zealand, is undergoing trial. Marshall's No. 3, a dual purpose wheat, is also useful for hay, but it must be cut very early, before the purple shade forms in the straw.

The manure found most successful in growing wheat for hay contains a fair percentage of phosphoric acid with small proportions of nitrogen (in the form of sulphate of ammonia) and potash, applied at the rate of from 60 to 80 lb. per acre. Last year, with 60 lb. of this manure, 53 cwt. of hay per acre were harvested from an area of 60 acres. On an adjoining block of 5 acres, separated only by the width of a drill tine (16 inches), which had not been manured for thirteen years, the yield was only 17 cwt. per acre. The gross difference in value is over £5 per acre.

March to the middle of April is found to be the best time for sowing wheat for hay in this district; but Firbank, being an early variety, might be sown as late as the beginning of May. An ample quantity of seed is 45 lb., drilled with the manure. Many of the successful crops of the Farm have been grown with 40 lb. seed per acre.

Tests at Wagga Farm have proved that the best stage at which to cut wheat for hay is when the plants are in flower, as the heaviest weights are obtained at that stage. The straw is then also much more palatable and easily digested than later on. The theory is that after flowering a large proportion of the weight of the grain is drawn from the straw.

Experience has shown that Sydney buyers require chaff of a bright green colour, cut long and clean so as to be free from the dust caused by crushing. In summer the use of the steamer is found of great advantage in preventing pulverising of the chaff, which is liable to occur in hot weather. All inferior sheaves are rejected, as buyers avoid a cut after having once found anything of inferior quality in the bags. These hints are the result of experience at Wagga, where hay is grown with an eye on the market.

Oats.

The cultivation of oats has been confined to the Experimental Plots, separated by the Farm buildings and a considerable area of undulating pasture land from the main body of the Farm. The reason is that wheat is grown for seed for distribution, and it is essential that the oats should be kept away to prevent admixture.

A considerable number of varieties have been tested for some years, with the result that for general reliability the Algerian far excels all others, being both drought and rust-resistant. Manurial tests have resulted generally in favour of the manure now on the market known as No. 3, applied at the rate of 84 lb. per acre, but last season the best results were obtained from 1 cwt. of ordinary superphosphate. The application of manure to oats has been as beneficial as in the case of wheat, as the use of the fertiliser last mentioned resulted in 25 bushels per acre more grain than from an unmanured test crop.

Barley.

Barley has been a very profitable crop. One of the most successful varieties has been the Skinless, or Silver Hull-less, for seed of which a large demand has been found from coastal farmers, who use it very largely as fodder for dairy cattle.

Over a series of years the best variety of malting barley has given an average of about 7 bushels per acre more than the best variety of wheat; and as a ready sale is always available for grain of good quality, the crop is so profitable that it is a matter for wonder that it is not more generally sown. We are still importing malting barley largely. Probably one of the reasons why it has not been taken up is that malting barley requires more careful harvesting than is the case with wheat, the use of the reaper and binder and threshing machine being very necessary. The stripper has a tendency to crack the grain, or injure the skin, which affects its value for malting.

The barley grown in Wagga District, although lacking in plumpness, compared with that grown in moister districts, is usually superior in colour, being much brighter owing to the very favourable conditions which usually prevail up to harvest time.

The price realised for the malting barley grown at the Farm has been from 4s. to 4s. 6d. per bushel. The best varieties have been found to be those of the Chevalier type, consisting of Kinver and Golden Grain. Goldthorpe produces grain of a very fine quality, but it is not so heavy a cropper.

Conservation of Fodder.

This is one of the first essentials of mixed farming in Australia, and Wagga Farm has not been behind in adopting the best methods known to the staff, for the purpose of meeting the requirements of the farm stock, instructing the students, and affording demonstrations to the district. In this, as in the other operations at the Farm, regard has been had to the probably limited means of those who may wish to follow the lead, and efficiency has not been obtained at the sacrifice of economy. Until recently stack silage was made, that being regarded as the cheapest manner in which to conserve succulent fodder, owing to the economy of stack-building. But stack silage has a few prominent defects, as a general farmer's method. All men are not skilled stack-builders; and if the fodder is required to be kept for more than a couple of years, the loss may be considerable, owing to the difficulty of excluding air. These considerations have induced the Manager to adopt the next cheapest form—the pit silo.

Pit or stack silos may be made at any convenient point to reduce cartage inwards and outwards, and a number of pits or stacks may be filled at the same time if labour is available, without duplication of expensive cutting and elevating machinery. The fodder is also placed promptly into the receptacle, whilst still in a succulent condition. When pits are used the teams and vehicles

employed in carting and filling form most useful factors in compressing the material so as to exclude air.

Dimensions as to stacks and pits to suit individual conditions are supplied to any inquirers at the Farm. The chief cause of failure is to spread the fodder over too large a base, thus exposing too great a surface to the atmosphere and reducing the necessary overlying pressure.

Dairy stock and lambing ewes are at present being fed on silage conserved last year at Wagga Farm, the produce looking fresh and palatable. The growth of barley, peas, lucerne, and grasses was sufficient to enable the conservation of nearly 700 tons of fodder.

Scooping out Silage Pit, Wagga Experiment Farm.

Other fodder reserves on the Farm at present comprise nearly 800 tons of wheaten hay, mentioned above, part of which will be sold when prices improve sufficiently; and upwards of 800 tons of straw. A baling press has been recently purchased, and it is intended to test the market with the straw as soon as conveniences for handling are available. It is a profitable item in dry seasons, and two years ago sales of straw chaff were made to over 120 farmers, enabling them to complete their ploughing and sowing for the season at a moderate cost.

Fruit.

The 95 acres devoted to fruit culture and drying have been most profitable, the total value of the produce (fresh fruit, dried fruit, almonds, oil, &c., jams and preserves, and cuttings) for the current year being £1,712. Prunes and sultanas cover the greater portion of the commercial area. A large number of varieties of apples, pears, plums, peaches, nectarines, figs, &c., have been tested. Originally single trees of each variety were planted on trial, and after about ten years' test a number of the varieties have been rejected and worked over to those kinds which have proved most successful. The largest number of failures were found in peaches and apples, for most varieties of which the rainfall is insufficient, the exceptions being the earliest varieties of peaches.

Tramping forage in Pit Silo, Wagga Experiment Farm.

Owing to insufficiency of sunshine at the time when prunes are ripening, it became necessary to instal an artificial drying apparatus. One of a highly satisfactory type was evolved by the Orchardist, Mr. Hogg, comprising two parallel chambers each about 60 feet in length which contain the fruit to be operated upon. Hot air is generated in a furnace below ground level, and brought by an exhaust fan to the fruit. In a comparatively short time it is sufficiently dry to be perfectly safe until a convenient time for the final process.

Earlier fruits, such as apricots, are dried simply by the heat of the sun.

The prices received for the fruits compare favourably with those of the Mildura and imported products. In point of size and colour of raisins, Mildura has the advantage of more suitable soil and means of irrigation. Irrigation is not provided at Wagga Farm. all the water used for stock being caught and stored in excavated tanks, and the domestic supply being received from the roofs.

The following is a list of the varieties of fruit which have been proved most suitable to the district:—

Apples—Granny Smith, Yates, Statesman.

Pears—Bartlett (Williams' Bon Chrêtien), Josephine de Malines, Anna Nelis.

Peaches—Alexander, Elberta, Hale's Early, Brigg's Red May, California.

Nectarines—Irrewarra, Stanwick.

Plums—Giant Prune, Angelina Burdett, Cyca Somomo.

Prunes—Robe de Sargeant, D'Agen.

Grapes—Sultanas for drying. Late varieties—Black Cornichon, Daria or Almeria, Flame Tokay. For home consumption—Black Champion, Mrs. Pearson, Gordo Blanco, and Black Tokay.

Horses.

Including brood mares, pensioners, and foals, there are 82 head of horses on the Farm. They are mostly Suffolk Punch crosses, and the cross has been found very satisfactory for farm work of all classes. The horses are speedy enough for the seed drill and binder, tractable, and easily trained to farm and road work. They are clean-legged, an advantage in a soil of fine texture which, when damp, adheres to the legs of hairy-legged horses.

Dairy Cattle.

Wagga is not a recognised dairying district, being too dry. On the river country Shorthorns do fairly well, but on the dry red-soil country they cannot be reared with advantage. The Jersey breed has proved highly satisfactory at the Farm. These cattle give a greater return in butter-fat in proportion to the cost of feeding than any breed tried in the district. A few Ayrshires are kept, which of course are superior to the Jerseys for quantity of milk produced; but when cream is considered, the Jersey leads the way.

The Farm herd comprises 3 Jersey bulls and 1 Ayrshire bull; 60 Jersey cows and 30 Jersey heifers; 12 Ayrshire cows and about half a dozen heifers. No steers are raised, the operations being confined to dairying. The bulk milk is tested several times a week for butter-fat and density. Every cow's yield (morning and evening milk) is weighed one day a week, and individual butter tests are made of every cow at least once a year—about a month after calving. There has never been a case of tuberculosis in stock bred on the Farm.

The chief item of note about the dairying operations is the exceptionally dry conditions under which they are successfully carried on. The cattle have to be fed on silage from November to August, as there is no cattle grass till spring.

Steam and hand separators of 100 and 40 gallons per hour capacity respectively are in operation, the steam from the boiler being also used for sterilising dairy utensils. Butter is extensively made, as well as cheese on the Canadian Cheddar principle. Last spring about 15 cwt. of cheese was produced.

Calves are fed by artificial teats at Wagga, and no evil results have been experienced; on the contrary, the very best results have been obtained, judged by the quality of the stock produced.

Pigs.

Several breeds of pigs have been tested on the Farm, but the Large and Small Yorkshires have been abandoned in favour of Berkshires, which have proved the most profitable. Many of the animals raised have been successful at inland shows, and considerable demand exists for the Farm strain across the Victorian border.

Grain screenings, rejected in the preparation of seed wheat, are used for feed, in addition to house refuse. A system of green feeding is also adopted, a number of acre paddocks being planted with barley, rape, and lucerne, and fed off in rotation. In some cases the growth of lucerne has been sufficient to make it profitable to cut it and feed in paddocks or sties. Of course the absence of irrigation is a drawback, except when sufficient showers fall to promote the growth of lucerne, the only permanent crop. In this connection, lucerne, though not comparing with results possible under either irrigation or sufficient rainfall, has been found profitable as a grazing crop when not prolific enough to cut.

Sheep.

Wheat and sheep are essentially the main product of Riverina, and no doubt will continue to hold pride of place, and in this variety of mixed farming the breeding of early maturing lambs is an important factor.

Cross-breeding was commenced at Wagga in 1901, the first cross tried being Shropshire ram on Lincoln-Merino ewe. But experiments were made to test the suitability of other crosses to the district, and at the present time there are eight first crosses and thirteen second crosses on the Farm. The aim is to retain as a permanent flock ewes which are good wool producers in addition to possessing the necessary size for mutton sheep, so that it has been considered undesirable to produce any lambs beyond the second cross. The first cross Lincoln-Merino has proved a most valuable mother for cross-bred lambs, on account of her wool-producing capacity, large frame, deep milking quality, and docility. The Leicester-Merino ewe also possesses all these good points, but tests have not extended over such a lengthy period. The Dorset-Horn Merino ewe, which produces less wool, is being tried on account of earlier maturity.

So far, in point of rapidity of growth, all crosses sired by Dorset Horn rams have had the advantage, and the carcases have generally been favourably reported upon by experts.

The Leicester and Shropshire have also proved valuable sires. The South Down was introduced two years ago, and the progeny have been highly commended for shapeliness of carcase and good quality of mutton. The Hampshire is also being tried, with fairly satisfactory results for lamb-raising. Cotswold and Cheviot sires have proved less satisfactory than any of the above.

The Shropshires, introduced during the early days of sheep-breeding on the Farm, are of excellent pedigree, a number of the foundation stock having been sired by an English Royal Show winner; and with one exception the rams used have been winners of prizes in Sydney or Melbourne. The Shropshires have proved remarkably hardy sheep, this breed showing the least loss during the drought of 1902, and readily responding to artificial feeding on dry fodders.

Pure-bred rams are always used on the Farm, and under no circumstances would a cross-bred or grade sire be used. This elementary principle of all stockbreeding is again emphasised, as unless the sire has been bred along one line for many generations there is no certainty as to his power to impress his characteristics upon his progeny, and reversion is almost certain to occur. It is strange that some breeders should still fail to appreciate this long established axiom.

In addition to natural pastures the sheep are fed on the stubbles following cereal crops, thus benefiting the succeeding crops by destroying weeds and adding fertilising material. Ewes actually dropping lambs are being fed on silage, and a few show sheep received ¼ lb. of oats per day and the pickings of a lucerne paddock during the dry weather.

The work with sheep at Wagga has proved highly profitable to the Farm, the ledger balance and value of stock on hand showing a credit of £4,500. Whilst valuable lessons in cross-breeding have been given to farmers and students, a substantial return has been gained by the State from the operations.

Poultry.

Ducks have not proved suitable to the dry climate and hard soil of the Wagga Farm, and their raising has been abandoned. Fowls and turkeys thrive exceedingly well. There are 89 turkeys and 200 laying fowls on the Farm at present. The breeds of fowls are White and Silver-laced Wyandottes, White Leghorns, and Black Orpingtons.

The fowl pens are 66 ft. x 33 ft., a size rather larger than is necessary for twenty head. The runs are regularly cultivated with Planet Junior hand plough, and green crops such as rape sown to purify the ground. The implement mentioned can of course be used in small pens where a horse could not work, and such cultivation should be practised by all poultry farmers, as it is an important factor in the suppression of contagious disease.

Pepper trees, which thrive under very dry conditions, are used for shade in the runs. Citrus trees would be better in a moister climate, as poultry manure is especially beneficial to them.

A chaff-bag full of oyster shells can be obtained for 1s., and these are used for grit, broken up with a hand mill.

The poultry houses are 7 ft. x 12 ft., roofed with iron, tarred inside and whitewashed or coated with Refrigerating paint outside. Bark is also recommended as a roofing material; it can be made as smooth as wood by taking the rough off with a spade as soon as it is cut, and it is an excellent non-conductor of heat. Of course the iron is more durable, and it is found cheaper than papering or roofing felt, which has to be painted about every three months, and requires wire-netting next the woodwork as a support.

Common sense precautions are taken to protect the birds from ticks. All the woodwork near the ground is tarred. All roosts are swung on No. 8 fencing wire from the roof, and kerosene is kept in tins on the wires when there is any danger of invasion. Another method would be to tar rags on the wires, renewing the tar about once a fortnight in cold weather to keep it fresh. Swung roosts also protect the fowls from lice, which will not crawl up the walls any height, and consequently cannot reach the roosts. All nests are kept away from the poultry houses, which leaves no lodgment for ticks to breed and accumulate.

Green feed is obtained from the produce of the Farm, and bread scraps are used in place of pollard. The morning meal generally consists of bread scraps soaked in water, milk or soup, with about equal parts of bran. The wheat is soaked for twenty-four hours in cold water before use, which swells it and makes it more digestible, besides increasing its feeding value by starting fermentation. The practice is strongly recommended.

Six incubators are used, with a total capacity of 600 eggs. Five brooders are provided, and in these again the practice of cultivation minimises loss from disease. Half of the brooder space is sown with rape, and when the chickens are ten days or a fortnight old, they are admitted to this area to graze—and they indicate their appreciation of the forethought of the Poultryman in an unmistakable manner.

Eggs were preserved in lime water last year to the number of 150 dozen. This is in addition to twenty dozen per week supplied to the Farm all the year round, besides the rearing of 300 chickens, and considerable sales of eggs. These are results which many poultrymen would be glad to receive from such a small establishment. The raising of turkeys at the Farm is being dealt with in a series of articles now being published in the *Gazette*.

Experimental Work.

On the 65 acres allotted for experimental work the value of various new crops to the district and new farming methods generally are continuously being tested. The wheat-breeding work of Mr. G. L. Sutton, Wheat Experimentalist, is carried on at a number of the Department's Farms, and Wagga has its full share.

A large number of tests are being made with wheat culture generally; manurial tests; rotation tests; tests of varying quantities of seeds for sowing

at different seasons; feeding off cereal crops—these and other experiments form part of the organised pioneering work of the Department, and are being carried out at Wagga as at the other Farms within the wheat area.

Manuring of lucerne is being tried now, as well as the treatment of lucerne and other legumes by inoculation of seed with bacteria. In the latter respect, however, the results so far have been negative. Trials of varieties of vegetables such as peas, tomatoes, pumpkins, &c., are made, all without the aid of irrigation and in an unusually dry climate. It is confidently hoped that these tests will result in materially improving the conditions of life in Riverina.

Educational Section.

The fifty-three students in residence on the Farm receive practical instruction in all the branches referred to above. The practice is to assign students to each of the departments, generally for a period of a fortnight at a time. Then in due course the student returns to that particular branch of the work. But exceptions are made in the case of orchard work, or long continued operations such as harvesting. Longer courses are given when specially desired on general orchard work, fruit-drying, dairying, and wheat-growing; but these are not regarded as special courses in the ordinary sense, as it is preferred that students should take the whole course. This includes Orchard, Experimental Plots, Poultry, Dairy and Piggery, Foreman's Branch (ploughing, sowing, harvesting, haymaking, chaff-cutting, use of engines, graders, and all necessary farm machinery), Blacksmith's work, Stables, Sheep, and Pastoral work (rabbit destruction, &c.).

For lectures the students are divided into two sections, each taking a week in turn at lectures, which are given on five afternoons a week.

Lectures are delivered fortnightly by Mr. T. G. Palgrave, M.R.C.V.S., Government Veterinary Surgeon, and Mr. J. Wrenford Mathews, Sheep and Wool Expert of the Department. Mr. C. C. Crane, B.A., House Master, conducts a class in book-keeping as applied to farm work, and lectures on elementary chemistry, botany, &c. Mr. A. L. Wyndham, Poultryman, delivers one lecture weekly on subjects concerning his department. Mr. S. A. Hogg, Orchardist, and Mr. W. G. A. Lee, Dairy Instructor, lecture once a week each on branches of their special work; and the Manager on raising of farm crops, stock, and general farm subjects.

One section of the students therefore devote six hours per day to practical operations each week, and attend lectures in the afternoons; the alternate week is fully devoted to field work. The other section go through the same course in rotation. The exceptions are the lectures on Veterinary Science and Wool, which on some occasions, all the students attend together.

The duration of the course is preferred to be two years, as naturally the students have an opportunity of seeing the work of some branches, such as harvesting and shearing, only once a year, and it is better that they should have a chance of going through these operations again.

B

The Cost.

Particulars of the expenditure in raising, and value of crops raised in the respective paddocks of the Farm last year are appended. The figures have been furnished by the Manager of the Farm. Included in the charges are, 6s. per acre for land interest or rent, and 2s. 6d. for wear and tear of machinery. Wages of the Foreman at 10s. per day, and those of farm hands ranging from 6s. 6d. to 8s. per day, with charge for advanced students at £1 per week, are also included.

Apart from the figures above referred to, a review is furnished of the commercial aspect of the work of the past nine years in cereal and hay-growing, showing the cost and value of the crops raised, with the percentage realised on the capital value of the land, which, during that period, has ranged in selling value from £3 10s. to £6 per acre, the average being fixed at £5.

To the other charges recorded in the ledger accounts is added 5s. per acre rental, and 2s. 6d. per acre for wear and tear and sinking fund of plant. All fodder used in ploughing and other operations is charged at market rates.

It should be especially noted that in the paddocks described has been carried out all the demonstration work of the Farm, consisting of variety tests, trials of kinds and varying quantities of manures, varying quantities of seed, broadcasting and drilling seed, plump and pinched seed.

Included in the costs are those of fallowing, and of raising cover crops, such as rape, which have been fed off by sheep, but for which pasturage no credit has been taken in the accounts.

The trials of varieties greatly reduce the possible earnings, as in a number of seasons there is a difference of 70 to 100 per cent. between the highest and the lowest yields. Unlike ordinary farm crops, a good deal of expenditure is necessary in examining the crops for foreign plants, which are all removed.

In paddocks 1 and 1A, crops for green fodder and silage have been grown for some years, and the cost of production has been credited.

The average annual rainfall for the period was 18·25 inches. The following are the figures :—

Years (inclusive).	Paddock No.	Area (acres).	Cost of Crops, Fallows, &c.	Value of Crops.	Per cent. Annual Return.
			£ s. d.	£ s. d.	
1901–1909...	3 & 3A ...	180	2,927 16 11	4,829 16 7	23
1901–1909...	2	142	2,775 5 2	4,927 3 7	33⅔
1901–1909..	4	90	1,826 3 0	3,180 0 0	28
1901–1909...	5 & 5A ...	316 (half cultivated each year).	3,172 6 0	5,264 5 7	29½
1901–1909...	6	73	1,144 16 5	1,763 0 3	21¼
1900–1908*	1	45	725 5 10	1,049 5 4	48
1900–1909*	1A	45	601 3 4	977 11 8	41¾
1908–1909†	7	35	113 13 8	317 7 6	48½ per annum for two years.

* Three years' commercial crops ; balance, fodders.

† One commercial crop, 1909, one maize crop, 1908, failed and fed off ; charges are for both years.

The capital cost of the school and farm buildings, clearing and fencing, without land, has been £26,513. The average yearly cost to the State during the past ten years since the farm has been in full working order has been £6,429, including cost of extensive buildings for students, &c., and the average revenue, without school fees, £3,579, so that the net annual cost of the place as an educational institution has been £2,850, less about £300 received for fees. Last year the total expenditure was £7,658, and the total revenue £5,072 (fees £672), making the net cost £2,586, which may be taken as a fair average. Practical men who know the educational value of the Farm—what an influence for good it has been in Riverina and similar districts, how it has gradually changed farm practice and introduced new crops, new methods, and new ideas—will not grudge the annual cost to the public treasury.

The following average crops were harvested last season :—

Wheat—

	a.	r.	p.	Per acre. bus.	lb.
Federation	50	0	0	26	15
Comeback	39	3	12	15	43
Bunyip...	38	0	0	17	25
Firbank	10	2	24	14	21
Huguenot	3	2	0	16	18
Florence	1	0	0	20	44
Warren...	2	0	0	18	8
Medeah...	3	0	0	15	33
Uppercut	0	2	0	23	40
Zealand...	35	0	0	23	20
Do	20	0	0	14	25
Marshall's No. 3	30	0	0	19	16
Plover	20	0	0	13	48

Barley—

Skinless...	40	0	0	25	26
Golden Grain	13	0	0	27	32
Kinver	11	0	0	27	21
Goldthorpe	17	0	0	17	12

Wheaten Hay—

	a.	r.	p.		tons	cwt.	qrs.	lb.
Unmanured	......				0	17	1	20
Manured	53	0	0		2	10	3	18
Do	90	0	0		1	16	2	9
Do	45	0	0	roughly tilled	1	7	2	16
Do	20	0	0	rough	2	6	0	13
Do	20	0	0	better tillage	2	10	3	0

STATEMENT of Expenditure, Receipts, and Value of Crops from Demonstration Area, year 1909–1910.

Dr. | Cr.

Paddock 3A, 90 acres.

Dr.	£	s.	d.	Cr.	£	s.	d.
Ploughing	19	0	2	1,112 bushels wheat	279	13	3
Harrowing and rolling	2	18	5	291 ,, barley	42	18	0
Sowing	7	3	10	69 tons straw	69	0	0
Seed	14	6	4				
Manure	11	2	3				
Examining for strangers	22	15	10				
Harvesting	39	2	4				
Twine	9	13	0				
Sacks	15	4	10				
Threshing and grading	46	17	1				
Rent on land, and plant wear and tear	38	5	4				
Balance	165	1	10				
	£391	11	3		£391	11	3

Paddock No. 5, 150 acres.

Dr.	£	s.	d.	Cr.	£	s.	d.
Ploughing	43	11	0	2,774 bushels wheat	681	13	0
Harrowing	7	5	9	75 tons straw	75	0	0
Rolling	2	3	1				
Drilling	15	4	5				
Manure	19	9	9				
Seed	26	18	9				
Examining for strangers	4	16	3				
Harvesting	63	9	7				
Twine	12	15	1				
Threshing and grading	83	16	4				
Sacks	32	0	10				
Rent on land, and plant wear and tear	63	15	0				
Balance	381	7	2				
	£756	13	0		£756	13	0

Paddock No. 6, 73 acres (less 12 acres ensilage).

Dr.	£	s.	d.	Cr.	£	s.	d.
Ploughing	31	13	8	Cost of silage transferred to dairy	11	5	10
Harrowing	6	11	5	1,480 bushels barley	264	8	11
Sowing	7	4	5	45 tons straw	45	0	0
Seed	12	12	3				
Manure	12	1	4				
Examining for strangers	13	12	7				
Harvesting	33	11	2				
Twine	4	10	2				
Sacks	14	6	0				
Threshing and grading	40	18	9				
Rent on land, and plant wear and tear	25	18	6				
Balance	117	14	6				
	£320	14	9		£320	14	9

STATEMENT of Expenditure, Receipts, &c., year 1909–1910—*continued.*

Paddock No. 7, 35 acres.

Dr.	£	s.	d.	Cr.	£	s.	d.
Fallowing	35	14	1	864 bushels wheat	212	7	6
Ploughing	8	3	5	111 tons straw (value)	111	0	0
Harrowing	1	18	10				
Sowing	3	2	1				
Seed	6	0	0				
Manure	4	8	6				
Harvesting	27	10	1				
Twine	5	5	2				
Threshing and grading	34	11	7				
Sacks	9	11	6				
Rent on land, and plant wear and tear	14	17	6				
Balance	172	4	9				
	£323	7	6		£323	7	6

Paddock 1A, 45 acres (rough cultivation).

Dr.	£	s.	d.	Cr.	£	s.	d.
Ploughing	10	13	0	58 tons hay (value)	174	0	0
Harrowing	2	2	7				
Rolling	0	13	0				
Drilling	3	7	5				
Seed	8	5	0				
Manure	6	7	10				
Examining for strangers	2	10	1				
Harvest (cutting, carting, stooking, and stacking)	27	15	11				
Twine	4	10	2				
Rent on land, and plant wear and tear	19	2	6				
Balance	88	12	6				
	£174	0	0		£174	0	0

Paddock No. 2, 140 acres.

Dr.	£	s.	d.	Cr.	£	s.	d.
Ploughing	36	10	6	223 tons hay (value £3)	669	0	0
Harrowing and rolling	11	4	2	Cost of growing silage, 40 acres ...	35	4	7
Drilling	9	0	5				
Seed...	31	4	7				
Manure	24	17	9				
Examining for strangers	7	1	11				
Harvesting (as above)	94	8	1				
Twine	11	11	9				
Rent on land, and plant wear and tear	59	10	0				
Balance	418	15	5				
	£704	4	7		£704	4	7

Paddock No. 4, 90 acres.

Dr.	£	s.	d.	Cr.	£	s.	d.
Ploughing	20	19	1	153 tons hay, at £3	459	0	0
Harrowing and rolling	5	10	6				
Drilling	5	17	8				
Seed	16	10	0				
Manure	15	1	8				
Examining for strangers	1	5	7				
Harvesting	66	17	4				
Twine	6	13	2				
Rent on land, and plant wear and tear	38	5	0				
Balance	282	0	0				
	£459	0	0		£459	0	0

DETAILS of Financial Returns from Paddocks, 1900 to 1909.

Dr. Cr.

Nos. 3 and 3A Paddocks, 180 *acres.*

	£	s.	d.		£	s.	d.
1900–9.							
To Fallows, &c.	108	13	4	By Produce	4,829	16	10
Crops charges	2,199	18	7				
Rent and wear	619	5	0				
	£2,927	16	11				
Balance	1,901	19	11				
	£4,829	16	10		£4,829	16	10
23 per cent. per annum.				By Balance—Profit ...	£1,901	19	11

No. 2 Paddock, 142 *acres.*

	£	s.	d.		£	s.	d.
1901–9.							
To Fallows, &c.	43	6	0	By Produce	4,927	3	7
Crop charges	2,192	7	2				
Rent and wear	539	12	0				
	£2,775	5	2				
Balance	2,151	18	5				
	£4,927	3	7		£4,927	3	7
33⅗ per cent. per annum.				By Balance—Profit ...	£2,151	18	5

No. 4 Paddock, 90 *acres.*

	£	s.	d.		£	s.	d.
1901–9.							
To Fallows, &c.	146	1	1	By Produce	3,180	0	0
Crop charges	1,338	1	11				
Rent and wear	342	0	0				
	£1,826	3	0				
Balance	1,353	17	0				
	£3,180	0	0		£3,180	0	0
28 per cent. per annum.				By Balance—Profit ...	£1,353	17	0

Nos. 5 and 5A Paddocks, 316 *acres* (half cultivated each year).

	£	s.	d.		£	s.	d.
1901–9.							
To Fallows, &c.	73	7	4	By Produce	5,264	5	7
Crop charges	2,565	3	8				
Rent and wear	533	15	0				
	£3,172	6	0				
Balance	2,091	19	7				
	£5,264	5	7		£5,264	5	7
29½ per cent. per annum.				By Balance—Profit ...	£2,091	19	7

DETAILS of Financial Returns from Paddocks, 1900 to 1909—*continued.*

Dr. Cr.

No. 6 *Paddock*, 73 *acres.*

	£ s. d.		£ s. d.
1901-9.			
To Fallows, &c.	78 14 8	By Produce	1,763 0 3
Crop charges	812 1 3		
Rent and wear	254 0 6		
	£1,144 16 5		
Balance	618 3 10		
	£1,763 0 3		£1,763 0 3
21¼ per cent. per annum.		By Balance—Profit ...	£618 3 10

No. 1 *Paddock*, 45 *acres* (*Grain crops three seasons*).

	£ s. d.		£ s. d.
1900-8.			
To Crop charges	191 2 1	By Produce	565 14 1
Silage crops...	483 11 3	Silage at cost	483 11 3
Rent and wear	50 12 6		
	£725 5 10		
Balance	323 19 6		
	£1,049 5 4		£1,049 5 4
48 per cent. per annum.		By Balance—Profit ...	£323 19 6

No. 1A *Paddock*, 45 *acres* (*Grain crops three seasons*).

	£ s. d.		£ s. d.
1900-9.			
To Silage crops, &c.	151 16 4	By Produce	977 11 8
Crop charges	381 17 0		
Rent and wear	67 10 0		
	£601 3 4		
Balance	376 8 4		
	£977 11 8		£977 11 8
41¾ per cent. per annum.		By Balance—Profit ...	£376 8 4

No. 7 *Paddock*, 35 *acres.*

	£ s. d.		£ s. d.
1908-9.			
To Fallow	35 14 1	By Wheat	212 7 6
Crop charges	64 17 1	Straw	105 0 0
Rent and wear	13 2 6		
	£113 13 8		
Balance	203 13 10		
	£317 7 6		£317 7 6
48½ per cent. per annum (2 years).		By Balance—Profit ...	£203 13 10

Wagga Experiment Farm Orchard Return—1909–1910.

Expenditure.

	£ s. d.	£ s. d.
Cash Expenditure—		
Processing	420 0 7	
Orchard	344 4 10	
		764 5 5
From Stores and other Branches—		
Processing	61 10 8	
Orchard	163 10 3	
		225 0 11
Building and Plant—		
Fittings	4 10 7	
Machines, &c.	29 2 10	
Renewals	96 10 10	
		130 4 3
Goods on Hand—		
1 August, 1909	......	239 9 6
Interest	......	238 4 0
Balance	......	377 17 1
		£1,975 1 2

Receipts.

	Cuttings. £ s. d.	Fresh Fruit. £ s. d.	Dried Fruit, Almonds, Oil, &c £ s. d.	Jams and Preserves. £ s. d.	Totals. £ s. d.
Sales	12 18 2	84 1 10	1,333 19 8	11 7 0	1,442 6 8
Transfers to other Farms and Head Office	26 5 0	....	18 15 0	....	45 0 0
Home consumption...	....	29 10 9	50 12 1	144 15 2	224 18 0
Goods on hand ...	....	....	....	....	262 16 6
					£1,975 1 2
			By Balance		£377 17 1

Bush Fires.

The great danger to farming operations in Riverina is the bush fire, and it may be interesting to conclude these notes by a brief description of the methods which are adopted at Wagga Farm to assist the district in controlling fires. So far there have only been minor outbreaks on the Farm itself, but the appliances are always ready for emergencies as well as to assist neighbouring settlers.

A fire cart is always ready at the Farm, with a large supply of hide beaters, wire-cutters, and other appliances kept in the cart ready for use. There is no special fire brigade, but certain students are chosen to work under directions, and they receive plenty of practice in the burning of fire-breaks.

During the dangerous months two fire-cart horses are specially kept in the stables, and are not allowed to be taken away for any other purpose. Keys of all the gates of the Farm are left available, so that stock can be readily mustered, and plans are fully organised for meeting fire at any point at which it may enter or occur.

On receipt of telephonic or other intimation of a fire within 10 miles of the Farm, the cart is sent out. It has been got away within ten minutes of notice being received. Of course, in the event of an outbreak on the Farm, neighbours would naturally be expected to help the staff.

When a fire is seen, observations are taken with instruments at the Farm, and information as to similar observations is obtained from a neighbouring station by telephone. The readings from the two different points are then plotted on a map with threads, the junction of the threads showing the position of the fire. Everybody within reach of the telephone is informed at once. By communicating with head-quarters of bush fire brigades in different localities, the Farm officials assist in enabling all available forces to be concentrated at the seat of the fire without delay.

This is a summary of the main work done at the largest Experiment Farm under the control of the Department, situated in the centre of the granary of the State. As the years pass by, Riverina becomes more and more valuable to New South Wales and to the Commonwealth—a home for those who wish to leave the city and rear their children under healthy conditions of agricultural life. What irrigation can do for New South Wales has yet to be proved, but that mixed farming—wheat and sheep—can give us millions of desirable citizens is amply demonstrated by the success which has attended the efforts of Riverina farmers during the past few seasons. The State is passing from a large lonely sheep-run, with a city at its gate, into an aggregation of cultivated paddocks dotted with such prosperous inland towns as Wagga. The officers of our Experiment Farms and of the Department generally are proud to have a share in the work of transformation.

Insectivorous Birds of New South Wales

[Continued from page 668.]

WE come now to another family of insect-eating birds which certainly merit our protection—the Wrens, or Superb Warblers, or "Cocktails," as they are popularly called. The genus *Malurus* is peculiar to Australia, and includes no less than twenty species. They are particularly valuable to the man on the land, as they fearlessly enter paddocks and orchards in search of insect food; whilst the brilliant colouring, pugnacious disposition, and pleasant song of the males render them objects of interest and delight to all those who, freed from the ceaseless clash of human intercourse in the cities, have opportunities of making friends with the bright creatures of the bush. We cannot give plates of the whole family of wrens, but we show two typical ones in this issue.

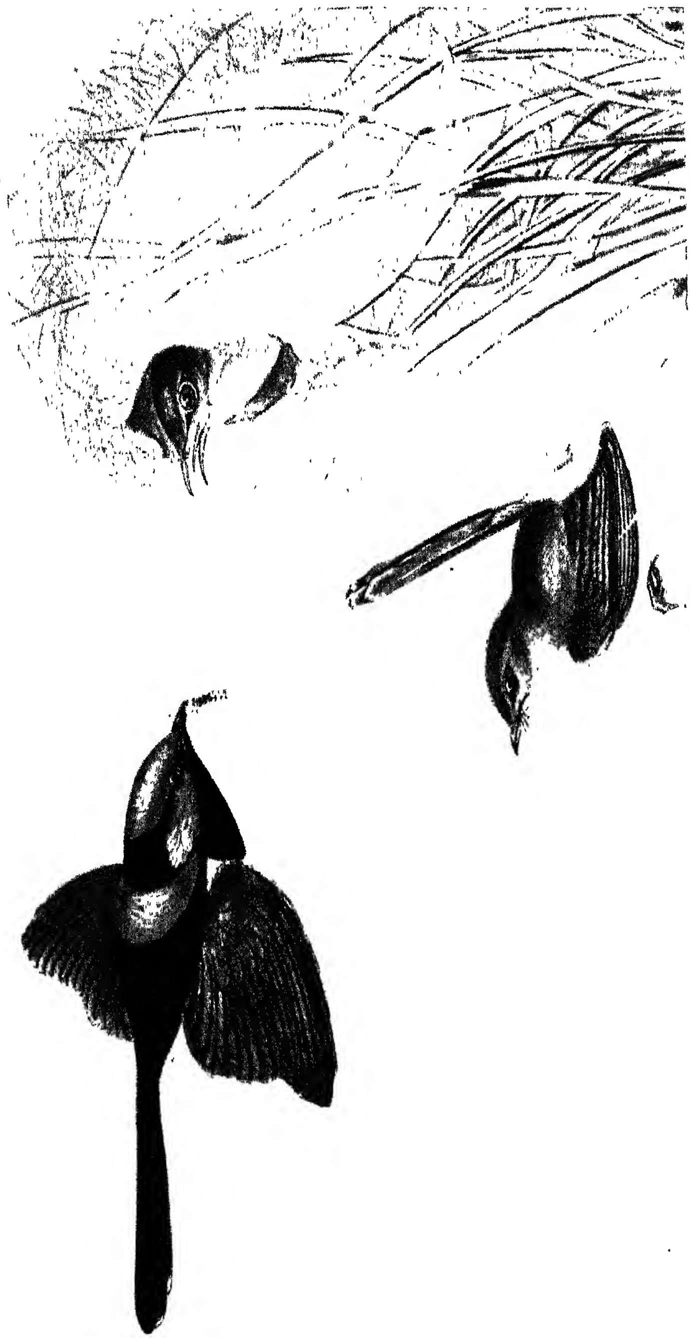
7. The Blue Wren.

This is the familiar "Cocktail" of the neighbourhood of Sydney, often known in other parts as "Blue-cap." It extends throughout south-eastern Australia, particularly near the coast, and is found well up into Queensland. It is our common suburban garden bird, and a troupe of Blue Wrens may be found at some time of the day going through rose-bushes, shrubs and plants in regular order, picking off aphids, soft scale, small moths, and tiny grubs. George Caley, the famous bird-collector of the early days of New South Wales, referred to these birds as "almost the only good songsters in the colony"—a mistaken impression which is largely held to the present day.

Mr. Hall says:—"The staple articles of their diet seem to be grass-hoppers, hard-winged insects, and larvæ." He quotes observations by Mr. Geo. Graham to prove that a wren can dispose of 100 grubs per day. Small beetles, caterpillars, moths, March flies, small-winged insects, blow-flies, and larvæ of cockroaches are all mentioned as among the dishes of the little gourmand. Whilst the conformation of the beak makes it very doubtful that the Blue Wren can manage grasshoppers or hard-winged insects, these remarks should be ample proof of the value of the birds as allies in the great fight against insect pests. Much of their food is obtained on grass lands, and they may be easily attracted by imitating their note.

The male Blue Wren is exceedingly pugnacious, and will peck at his image reflected in a window, or even a piece of bright tin. Mr. North also gives instances of the birds feigning death in order to escape from their captors. Mr. Hall says as many as five have been seen fighting over a single female at the commencement of the breeding season.

Varying opinions are held by competent observers as to the moulting of the male Blue Wren. Mr. North has noted fully-plumaged males at all times and seasons, whereas Mr. Campbell has collected observations, in Gippsland particularly, to support the theory of a double moult, *i.e.*, into brown plumage



INSECTIVOROUS BIRDS OF NEW SOUTH WALES.
"BLUE WREN."
MALURUS AUSTRALIS, *North.*

INSECTIVOROUS BIRDS OF NEW SOUTH WALES.

"ORANGE-BACKED WREN."

MALURUS MELANOCEPHALUS, *Vig. and Horsf.*

and back into blue. It is probable that the blue plumage is never lost, though at moulting time there may be less blue than usual; and that first-year birds, changing from brown to their adult blue plumage, which may be collected during the winter months, have caused the confusion. Young male birds of first year resemble females in appearance, assuming the adult plumage at first moult.

The Blue Wren builds its nest at the latter end of July. It is a dome-shaped structure, with the upper end slightly overhanging a narrow entrance at the side, and constructed of bark-fibre and grasses, lined with feathers, fur, hair, or wool. It is usually built in shrubs near the ground, and prickly hedges, briar or blackberry bushes—especially with grass growing through them—are favourite sites about gardens. The eggs are white, spotted with pale red or reddish brown. Three or four are usually laid; but the birds are persistent breeders, and will lay again and rear their brood even after the nest has been robbed four times.

8. The Orange-backed Wren.

Our friends on the North Coast have the aid of another wren in their fight against insect pests. The bird illustrated is sometimes called the "Red-backed Wren"; but this name had better be reserved for the species *Malurus dorsalis* (*cruentatus*), which is confined to the northern parts of Australia.

The Orange-backed Wren has been recorded on the Coast as far south as the Paterson River. It is freely dispersed about the Upper Clarence district, chiefly frequenting patches of blady-grass, swampy country, and the borders of creeks. On the coast it is generally found in open heath country. Unlike the Blue Wren, the birds are very timid, and quickly conceal themselves when danger is about.

Mr. North has examined a number of stomachs of these wrens, and found the contents to consist of various insects—principally the heads, legs, and wing-cases of small beetles.

The nests are oval in shape, with rounded entrance near the top, and usually built in long coarse grass. The eggs are white, spotted with pinkish-red to reddish-brown.

These two birds are typical of the Wren family. Other species include the White-winged and White-backed Wrens of the interior of the State, Lambert's Wren (with chestnut shoulders), and other beautiful gems. Some of them threaten to become extinct as settlement advances; but they are all worthy of protection by those who wish to keep down their spraying bill. We feel sure that attention has merely to be drawn to their immense practical value in order to reduce the destruction of these pretty little songsters. Encourage them in every way, because they help in no small degree to render agricultural life profitable and pleasant.

These birds may easily be preserved and encouraged by leaving patches of bracken, grass, &c., around the edges of cultivation paddocks, which afford cover for the birds, and from which they may sally forth to do their good work among the crops.

Judging Fruits.

J. G. R. BRYANT.

In the judging of fruits at our shows, little or no method seems to direct exhibitors or judges. This subject needs much closer attention, as the most important point of agricultural shows is their educational value, *i.e.*, in educating the grower, and thereby influencing him to something better. With a view of bringing system into the judging of fruit, the following points are suggested. It would not be practical to make the rules as here set down hard and fast, but in cases where there is a doubt or close finish, the judges will find it advisable to follow the rules closely.

Exhibits should be strictly in accordance with the rules of the society, and any departure therefrom should disqualify.

Each specimen should belong, without doubt, to the class in which it is exhibited.

Excellence in the exhibit itself should receive attention, rather than the way in which the exhibit is shown.

Each article shown should be in proper condition for exhibiting. This includes that, unless otherwise specified, fruit should be fit for immediate use.

The prizes should be awarded according to the general excellence of the exhibit. This means that all exhibits should be judged on the principle of giving the prize to the one that excels in the majority of the points by which that kind of exhibit is judged, rather than any special point.

Societies should avoid offering prizes for classes which are not in season at the date of the show.

Condition.—Dessert fruit should be ripe and fit for immediate use, except in cases where fruit for keeping or export is specified. Culinary fruit should be in the condition in which it is required in the kitchen. Fruits which do not mature on the tree, or which mature as well or better when stored after being pulled, should still be in mellow condition, brought about by such means. This includes mostly apples, pears, &c., and does not exclude citrus fruits so treated.

Where fruit suitable for keeping or export is required, the stage of ripeness to suit the proposed storage is most important. This may vary in accordance with the market proposed to be supplied.

Cleanliness should always be considered.

Size and Colour.—Both require attention in different degrees in the various subjects. Size without even grading, and without fine surface, counts for but little; with these, so long as coarseness is avoided, it is a useful quantity.

Fruit showing rough form, picking without the stalk, or injury of any kind, should lose points, while the presence of fungus or insect diseases should disqualify.

The accompanying score-cards will give a general idea of the system by which fruit should be judged. The score may slightly differ so as to give more or less prominence to the special objects for which any class of fruit may be grown in a particular locality.

Class.......... No...... Exhibit of.......... Exhibited by..........

	Points possible.
Market value	30
Flavour	10
Form	5
Colour	10
Size	10
Keeping and carrying qualities	20
Correct naming	10
Get-up of exhibit	5
	100

Stone Fruits.

Period of maturity	10
Freedom from blemishes	5
Shape and colour	15
Flavour and texture	15
Pit	5
Dessert, drying, or canning	25
Carrying qualities	25
	100

Grapes.

Flavour	15
Size of bunch	5
Form of bunch	5
Size of berry..	10
Skin and bloom	10
Colour	5
Texture	10
Seeds	5
Keeping and carrying qualities	20
Adherence to stem	5
Freedom from blemishes	10
	100

After a careful study of these points, the decisions rendered on a large display of fruit would be more satisfactory. It would be a systematic way to judge and award prizes. It would make a short and accurate summary of

the characteristics of fruits. Each character of the fruit would be considered when the grower extended the improvement of any variety, and all the characteristics would be clear in the operator's mind.

The above scale of points only includes the fruit, but as the tree is part of the variety, it must also be considered. The following scale of points for trees is suggested:—

	Points possible.
Productiveness	40
Vigour, healthfulness, and habit of growth	20
Uniformity in size	15
Uniformity in maturity	10
Adherence of fruit to tree	15
	100

Black Maize.

Mr. F. W. Kelf, of Coramba, recently forwarded to the Minister of Agriculture a sample of black corn grown by Mr. A. W. Porter, Bucca Creek. About four years ago Mr. Porter noticed a black grain in a cob of yellow maize, and by planting it he has now a large quantity. He claims that the weevil, which is so destructive to other corn, will not touch this variety.

Mr. F. B. Guthrie, Chemist of the Department, analysed the black maize, and reported as follows:—

Analysis of "black maize" grown by Mr. A. W. Porter, Bucca Creek.

	Black Maize.	For Comparison. White Maize.	Yellow Maize.	Argentine Maize.	Bulk sample N.S.W. Northern Rivers' Maize.
Moisture	11·98	12·72	12·75	12·07	11·36
Albuminoids ...	7·69	10·99	11·37	10·13	10·06
Ether extract ...	4·09	3·54	4.60	4·47	4·57
Fibre	1·24	1·61	1·48	1·54	1·53
Ash	1·12	1·39	1·27	1·35	1·32
Nitrogen free extract	73·88	69·78	68·53	70·44	71·16
	100·00	100·00	100·00	100·00	100·00
Albuminoid ratio ...	1 to 10·8	1 to 7	1 to 7	1 to 8	1 to 8
Nutritive value ...	90·8	88·7	91·4	90·6	91·5

The sample of "black maize" differs chiefly from the other varieties of maize examined in being considerably poorer in albuminoids (nitrogenous matter), and consequently more starchy. This would make it somewhat less valuable as a food for stock.

If it is true that it is not attacked by weevil, it might be well worth while to try and increase this nitrogen-content by selection.

If it is found to be attacked by weevil, this variety has nothing to recommend it over the ordinary varieties.

With regard to its possible value in the production of corn-flour, it would be advisable to submit samples to manufacturing firms. It certainly contains a larger proportion of starch than the ordinary yellow variety, but it cannot be said whether or not the pigment would affect the colour of the product.

Grade Guernsey Cattle on the Richmond.

A GREAT deal of interest has been shown in the articles by Mr. M. A. O'Callaghan, Dairy Expert of the Department, in the *Gazettes* for March and June, 1910, giving the results of experiments with Guernsey sires, and advocating the use of a pure-bred Guernsey bull to improve the milk yield of the Richmond River dairy stock.

Confirmation of the opinions expressed is furnished by Mr. James Sheehan, of Coraki, who has supplied the Department with photographs and yields of some of his cows, on third calf, by the imported Guernsey bull Peter. Photographs of Peter will be found in March and June *Gazettes*, pages 203 and 482 respectively.

Fig. 1.—Emma.

Fig. 2.—Nancy.

Fig. 1 is Mr. Sheehan's cow Emma, by Peter, from a Shorthorn cow. Her yield was tested on the 15th June, 1910, with the following result:—

Morning's milk, 20 lb., testing 4·4 per cent. butter fat.
Evening's milk, 16 lb., testing 5·5 per cent. butter fat.

Fig. 2 is Nancy, a cow bearing a strong resemblance to Peter, though Mr. Sheehan is doubtful whether he is her sire. Her yield was:—

Morning's milk, 24 lb., testing 2·65 per cent. butter fat.
Evening's milk, 21 lb., „ 4·0 „ „

Fig. 3 is Roany, by Peter, from a Durham cow:—

Morning's milk, 19 lb., testing 3·8 per cent. butter fat.
Evening's milk, 15½ lb., „ 4·4 „ „

Fig. 4, Buttercup, is also by Peter, from a Durham cow:—

Morning's milk, 20½ lb., testing 4·6 per cent. butter fat.
Evening's milk, 15¼ lb., „ 6·25 „ „

Fig. 5, Cherry, by Peter, from a Durham cow:—

Morning's milk, 21 lb., testing 3·0 per cent. butter fat.
Evening's milk, 13 lb., „ 4·1 „ „

Fig. 6 is Kathleen, also by Peter, from a Durham cow :—

Morning's milk, 20½ lb., testing 3·6 per cent. butter fat.
Evening's milk, 10 lb., „ 4·8 „ „

This cow calved on 22nd December, 1909.

Mr. Sheehan adds that these cows were not specially prepared for the test in any way. They were in the same paddock as the rest of the herd, and it was raining the night before and all the day that the test was taken. They received no hand-feeding. The paddock is grassed with paspalum, couch and clover.

Fig. 3.—Roany.

Fig. 4.—Buttercup.

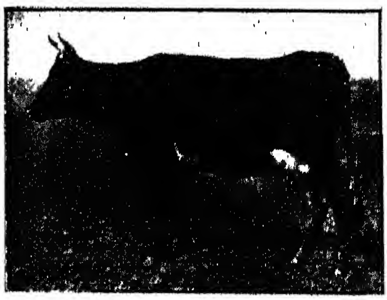


Fig. 5.—Cherry.

Fig. 6.—Kathleen.

Fig. 7.—Guernsey Bull by Vivid's Prince from Souvenir (imp.); bred at Wollongbar Experiment Farm, and purchased by Mr. Sheehan.

Alfalfa (Lucerne) Meal.

GEORGE VALDER.

For some years past a number of preparations of ground alfalfa (lucerne), with or without the addition of other ingredients, have been used in the United States for feeding to stock, and a number of factories have been erected, with more or less expensive machinery, for the purpose of grinding alfalfa hay. There appears to be a probability of some of these preparations being placed on the local market, or of plants being erected in New South Wales.

A sample of one product was recently supplied to me by Mr. F. Close, Manager, New Zealand Loan and Mercantile Agency Company, Limited, and analysed by Mr. F. B. Guthrie, Chemist of this Department, who furnished the following report:—

	per cent.
Moisture	10·64
Ash	8·35
Fibre	29·19
Ether Extract (fat, &c.)	1·30
Albuminoids	15·31
Carbohydrates	35·21
	100·00
Nutritive value	53·4
Albuminoid ratio	12·5

The above analysis very closely resembles that of an average sample of lucerne hay, and the product would appear to be chopped-up lucerne.

It seems that this particular preparation consists mainly if not wholly of lucerne. Various materials are, however, contained in the brands on the American market, such as cracked corn, oats, oat hulls, cotton-seed meal, linseed meal, corn meal, dried brewers' grains, wheat bran and middlings. Another common preparation is a mixture of 75 per cent. alfalfa and 25 per cent. molasses. These must not be regarded as adulterants, as lucerne is extraordinarily rich in protein, and requires the addition of other foods to "balance the ration" before it is a complete fodder for stock. Analyses recently made of alfalfa feeds by the Chemists of the North Carolina Department of Agriculture showed that these feeds are composed of nutritious ingredients, and that in only a few cases have low-grade materials been introduced into them.

It is impossible for the Department to give more than very general information on this matter at the present time, as the method has not been tried in this State. In American official publications conflicting opinions

are expressed; but the following appear to be the main advantages of treating lucerne in this way:—

(1.) Greater digestibility. Lucerne is a coarse feed, and grinding must necessarily reduce the labour required for its digestion.

(2.) Saving of waste. The leaves of lucerne are the most valuable portion of the plant, and in baled hay a considerable proportion of the leaves is lost in handling.

(3.) More intimate mixture of the ration. It is suggested by Professor H. M. Cottrell that ground alfalfa mixed with corn meal is far superior to the whole hay fed with corn.

From this, it seems probable that the marketing of lucerne in this form will have its advantages when the product has to be carried considerable distances to the consumer. Mr. F. D. Coburn, Secretary of the Kansas Department of Agriculture, states that "the use of the meal or the food preparations is likely to prove more especially valuable for dairy cows and poultry."

As against this, however, must be placed the question of cost. In Bulletin 155 of the Kansas State Experiment Station, the following remarks are made:—

While we have not been able to carry out carefully conducted feeding experiments with this product of the alfalfa-mill, we do not feel it will prove to be as valuable for feeding dairy cows as some other class of live stock. The dairy cow not only has room for but needs a large amount of roughage in her ration, and in view of the difference in price between the meal and the hay, which, by the way, must be practically the same in feeding value, we do not think that it is economical to purchase the meal, except in special cases to be used in the place of bran for lightening up a heavy grain ration. We believe the cow can do this grinding cheaper and to better advantage than the mill.

In the Annual Report of the Bureau of Animal Industry, U.S. Department of Agriculture, for 1904, Mr. I. D. Graham states:—

Experiments made at different experiment stations and also by private individuals, have shown that alfalfa meal, when balanced with a corn ration and some kind of roughness rich in carbohydrates, makes a very satisfactory ration for fattening stock, but a prominent cattle and horse breeder, who annually harvests 2,000 acres of alfalfa, says that, in his experience, the cattle themselves make a very good mill to grind the alfalfa, and he finds it too expensive to grind it by other power. He confesses that he has had no very great experience with alfalfa meal as sold commercially, but thinks that the consumer pays a good price for its preparation. . . . Some experiments recently made at the Nebraska Experiment Station show that, in feeding pigs, the largest daily gains were made on corn and shorts, but that a gain practically equivalent was made at a much lower cost where either cut or ground alfalfa was substituted for shorts in the ration. The cheapest gains were made on corn and cut alfalfa.

Nevertheless, with modern economic construction of machinery, it should be worth while for our large growers of lucerne to look into this matter further and consider whether the installation of grinding machinery would not be a profitable undertaking, as undoubtedly the product, when placed on the market in sufficient quantity, would find a ready sale.

Trial of Burnham's Stone-gathering Machine.

In the presence of Mr. George Valder, Chief Inspector of Agriculture, a trial of this machine was made on 15th June, at Maryvale near Wellington. About twenty-five of the leading farmers of the district witnessed the trial.

Burnham's Stone-gathering Machine.—Before using.

Burnham's Stone-gathering Machine.—After using.

The land selected is the property of Mr. W. C. A'Beckett, but is leased by Mr. Geo. Hubbard, who found the team for drawing the machine, and carried out the trial.

Mr. Valder has supplied the following report:—

From what I know of this country, I should say that it was rougher than the average stony land, being heavily covered with limestone; but Mr. Burnham stated before the machine was started that he considered it to be quite fair for the trial.

After an hour's work it was found that the machine had raked together and piled in rows the stones on an acre of land. The work was well done, and evidently the machine could be made to be of great service in this as well as in other districts where there is any large quantity of stony land. On examining the machine after the trial, however, it was found that the weakness indicated by the Department of Agriculture of South Australia, viz., "tynes not strong enough," was very evident. Two tynes were broken short off, and nearly all the others were bent out of shape. Of course this is a fault that can be remedied, but until it is remedied the machine cannot be recommended.

The machine was drawn by six medium draught horses, but it was very heavy work for them.

There is a considerable quantity of stony land in the Wellington district, in patches ranging from 1 acre to as much as 40 or 50 acres. This land, which is now almost valueless, would be brought under cultivation if the stones could be cleared off, as much of it is a portion of the best wheat-growing land in the district. Experience shows that it costs too much to clear the stones off by hand, but if a machine can be found to do the work cheaply it would be a great benefit to the farmers owning this land, hence the interest taken in the trial of the machine.

Specific Gravity and Treatment of Seed for Smut.

In Circular No. 62, Bureau of Plant Industry, United States Department of Agriculture, Mr. H. B. Derr, Agronomist in Charge of Barley Investigations, recommends a method of separating seed barley by immersing it in water, when the light and shrivelled grains and many of the oat and weed seeds will float on the surface if the grain is stirred, and may be skimmed off. The circular refers to other seeds which may be separated in this way, and instances an experiment of Dr. T. L. Lyon, Nebraska Experiment Station, who made selections of wheat by the specific gravity method, and secured increased yield from the heavier seed. Of course the liquids would need to vary in density with the different kinds of seed.

Mr. Derr also mentions that the barley seed may be treated for smut at the same time by substituting a formalin solution for the water.

It seems unlikely that the specific gravity method will ever replace the grading machine; but the matter shows an additional advantage in treating seed for smut in such a way that the unbroken bunt balls may be removed. Light grains, weeds, chaff, &c., will also float on the surface of the pickling liquid, and can be removed at the same time as the unbroken bunt balls.

Blue Couch as a Lawn Grass.

J. H. MAIDEN,
Government Botanist, and Director of the Botanic Gardens, Sydney.

SOME years ago a short grass with a blue cast of foliage made its appearance in the Botanic Gardens. Its botanical position appears to be that of a variety (*brevispicatum*) of the common summer grass, *Panicum* (*Digitaria*) *sanguinale*. It continued to spread in the Botanic Gardens, and its presence was viewed to some extent with curiosity. Afterwards it appeared in the Federal Government House Grounds. As it had a somewhat dingy appearance I was consulted by one of our Governors, some years ago, with a view to its eradication from the garden, and particularly from a tennis lawn. A few sods were taken out, but nothing was done in the way of systematic eradication. During the last few years no complaint has been made in regard to it.

Attention has been again drawn to this grass by Mr. Ernest A. Bonney, of Longueville, near Sydney, a gentleman who has had very considerable experience in regard to bowling-greens and croquet lawns. He very kindly drew up a statement of the merits and demerits of this grass so far as his experience goes; while Mr. T. G. Weston, head gardener, Federal Government House, has been good enough to give me a report of his experience in the Grounds to which I have already referred. The botanical name of the Couch grass referred to in comparison is *Cynodon dactylon*.

So far as I know, public attention has not been drawn, at all events prominently, to this new component of Sydney lawns. Given favourable conditions, it is an aggressive grass, and there is no doubt it will be heard of during the next few years.

It would be desirable if correspondents would kindly favour me with information as to the extent to which Blue Couch has spread in this State, and what their experience of it is. The reports I give are from places on the shores of Port Jackson, and experience of it away from Sydney may be quite different.

It is quite impossible to say when it first made its appearance in Sydney. It is supposed to be of American origin, but how it first came into the Botanic Gardens can only be guessed at.

Mr. G. Harwood, the Superintendent of the Botanic Gardens, remembers it for about thirty years, but he has not heard of it except in the Garden here.

Mr. Ernest A. Bonney's statement:—

After an experience of five or six years of this grass on my croquet lawn at Longueville, on the Lane Cove River, my opinion is that it is much more suitable for bowling greens and croquet lawns in the coastal districts of New South Wales, especially in loamy or sandy soil, than the Couch, which is so generally used around Sydney. I am endeavouring to obtain seed through one of our seed merchants, as I anticipate having to superintend the laying out of several croquet lawns at Rushcutter's Bay shortly, and

shall certainly sow the seed if it can be obtained, not only there, but also on my own lawn when it is top-dressed this spring. My own lawn was made about nine years ago in dark sandy soil, the surface of which contained a considerable quantity of decayed vegetable matter. Being on the side of a hill, the soil was excavated about 5 feet deep on one side, and banked up about the same height on the other side, the depth of the soil after the surface was made level varying from about 2 feet to 10 feet. About a fourth part of the lawn was turfed, and the remainder planted with Couch. About three years afterwards I noticed the Blue Couch, but do not know where it came from, as I have not seen it about Longueville. It gradually spread, and now covers an area of about 300 square feet, and is continuing beyond the boundary of the playing area, where it has an opportunity of running to seed. It is also appearing in other parts of the lawn about 60 feet from the original patches. It would have covered a much larger area had I not spread a considerable depth (from 2 inches to 3 inches) of top dressing over parts of the embanked portion of my lawn about eighteen months ago. Most of this top-dressing was sandy soil put through a ¼ inch screen, finished off with about ⅜ of an inch of stiff dark soil that had been screened through fine wire gauze. It was several months before the Blue Couch struggled through, and I was very much afraid it had been killed. However, it is spreading again.

The advantages of this grass over Couch are as follow:—1. It is much less trouble to keep it in order, as the leaves being soft and succulent, and there being an absence of tough runners, and the growth being less rapid, the mowing during the summer months takes about a quarter of the labour.

2. The leaves being broader and the roots forming a thick fibrous mass, the surface is always well covered and stands more wear, as there are no bare places to be pitted into holes by the rain and wind. The leaves being of a softer texture, it is unnecessary to grind the lip of a Green's lawn mower, as much less resistance is offered to balls passing over it, and that resistance remains more even throughout the day.

3. It eradicates all other grasses and weeds on my lawn. Wherever it appears the Couch disappears entirely, and at the present time (17th June), when what we call winter grass and many objectionable weeds are coming up in the Couch, the parts covered with Blue Couch are perfectly free from all other grasses.

4. It stands the cold weather better; it is still green and growing whilst the Couch is looking brown and its growth has stopped. A severe frost turns it brown.

5. It requires less top-dressing, and is better without any, if there are no subsidences in a lawn. Only sufficient to level the surface should be put on, as it does not require fresh soil to feed upon. A little fertiliser is quite sufficient.

The only objections that I know of are:—Firstly, it dies off sooner during a long term of hot dry weather; but it recovers very quickly after rain, and as all lawns during such times have to be watered, it is only a matter of using a little more water, the cost of which is less than that of the extra labour required by Couch. Secondly, the colour of the grass, which is never a bright green, being a blue green in summer and yellow green in winter; but as it is all one colour, this is preferable to the numerous tints which are so often found in a Couch lawn—especially during the winter. I shall watch with interest for the Blue Couch to come into contact with clover, which is so troublesome in most lawns, to see which will survive in the struggle for existence. It spreads on the lawn, where it is rolled and mown frequently, slowly in all directions, and does not send out runners, although it appears to do so when it reaches loose soil.

Mr. T. G. Weston's statement:—

It is a first-class grass for lawns, providing it be kept close mown and well watered during dry weather.

Little or no top-dressing is needed for grass on ordinary lawns. On tennis lawns, &c., a light surfacing of fine sandy loam will be needed to keep a really good surface.

In competition with Couch grass it always obtains the mastery. Especially is this noticeable on closely cropped lawns. The dense growth of the Blue Couch appears to smother the Couch.

Weeds such as clover, Oxalis, Medicago, &c., are just as troublesome on lawns covered by Blue Couch as those laid down on Couch. It succumbs to asphalt or drought quicker than Couch does, but recovers much more rapidly. Lawns that were to all appearance dead, and upon the surface of which one has been afraid to use a broom, have, after a soaking by rain or sprinklers, recovered in two or three days to such an extent that the lawn-mower has been needed. It forms a denser surface than the Couch, and its runners are only about the same thickness.

It travels over the surface much more slowly than Couch, but in forming new lawns, if seed were used, this would be an advantage, as the dense surface, so much desired, would be more quickly obtained.

Providing it be kept close mown, it is an easy grass for the lawn-mower. If, however, it is allowed to obtain a little headway, especially during its flowering period, it will give the machine a large amount of trouble to reduce to a smooth uniform surface, as its stems pass in numbers between the knives and cutting-plate, and remain unsevered, presenting a mangled appearance. If the lawn-mower is in first-class condition this does not happen, but practice and experience demonstrate that lawn-mowers are seldom in this much to be desired state.

If allowed to grow at will, few grasses give the really good scythe men more difficulty to mow creditably than this.

Conclusions.—After two and a half years' experience I should still give Couch grass the preference for fine lawn work.

It stands wear and tear better.

It withstands drought better.

During dull and showery weather it dries more quickly.

It gives less trouble to the mowing-machine.

It is quickly and easily repaired.

Its runners lie closer to the ground.

Weeds are removed more easily from it.

Japanese Hemp.

At the end of last year the Department of Agriculture received from Mr. W. F. Lawry, of the New Zealand Loan and Mercantile Agency Company (Limited), samples of Japanese hemp seed obtained from California, U.S.A., where the plant is apparently proving successful, it being claimed to reach a height of 10 or 12 feet in five months. The seed was distributed for trial at the Hawkesbury Agricultural College and Bathurst and Grafton Experiment Farms. At Bathurst and Grafton it failed to germinate. At the College, where it was planted on poor sandy soil on 28th December, 1909, the crop was very patchy, ranging from 6 inches to 2 feet in height. The weather conditions throughout were favourable to its best development. Upon examination the roots proved to be badly attacked by eel-worms, which, no doubt, were partly the cause of the poor results obtained.

The quantity of stalks yielded was too small to warrant the extraction of fibre by retting, but on separating the bark from the stem by hand it was observed that a considerable amount of this commodity was present.

The plants produced upright stems free from branches. During April a few flowers were formed, these being large, open, and white in colour, with a purple centre. The stems and sepals were slightly prickly.

The plant appears to be *Hibiscus cannabinus*, also known as "Deccan hemp." Although a fibre plant it is wrongly termed hemp, being quite distinct from hemp (*Cannabis sativa*) and Sunn hemp (*Crotalaria juncea*). *Hibiscus cannabinus* is grown by the natives of India and used for making rope, string, and sacks, the fibre being very similar to jute.

Rhodes Grass.

Mr. Patrick Grant, of Nambucca River, Macksville, writes:—

On reading note *re* Rhodes Grass by Mr. Harrison, in June *Gazette*, I thought it might interest the farmers along the coast to know how the grass was suiting this district, which for soil and climate is a fair average of the North Coast.

Two seasons ago I put in a few pounds round my homestead, mostly where stock are continuously present, but in spite of that it has grown and spread extensively, without having any chance to seed. On the other side of the fence, where no stock touched it for some months, it grew 4 feet high, and seeded like a field of wheat I let the milkers in after pulling the seed, and they ate the grass greedily.

Last November I burned off a block of 80 acres, and on 20 acres of the worst country sowed about 8 lb. paspalum and 1 lb. Rhodes grass per acre. The Rhodes covered more ground, gave more feed, and ripened seed abundantly during May.

One farmer tells me he has 100 acres solely Rhodes, and that the cows (he milks about 70) do well on it; and unless something better comes along he will never sow new land without Rhodes. Another large dairyman, with 40 acres solely Rhodes, says he will always sow Rhodes with paspalum to keep down the weeds, as, apart from the feed, the saving in brushing will more than pay for the seed, which on this river is advertised in the local Press at 1s. 6d. per lb. Some people talk of 2 lb. seed per acre, but I think Mr. Harrison is nearer the mark in saying 5 lb., if sown alone, as if too scattered the long runners are liable to be torn up and eaten, roots and all.

The grass has been in this district only a few years. Some say paspalum will kill it out; my observations do not lead me to think so. In a neighbour's paddock a small quantity of Rhodes was sown with paspalum about four years ago. The Rhodes is still holding its own, though it is not so vigorous as if by itself; but even if the paspalum crushed it out on the richer lands, the Rhodes will more than hold its own on the poorer soils. No doubt Rhodes has come to stay, and if our stock could talk they would express their satisfaction in having a change from the valuable but, in this and some other districts, monotonous paspalum.

Burwood Boys at the Hawkesbury Agricultural College.

Mr. W. H. Teale, Headmaster of the Burwood Superior Public School, acknowledges the pleasant and instructive time which one of his classes recently enjoyed at the Hawkesbury Agricultural College. He points out, as showing the good effects of such visits, that fully one-third of the boys leaving Burwood school during the past three years have gone on the land. Such a result from one of the largest schools in the State is very gratifying.

Farmers' Wheat Experiment Plots.

In the table accompanying the report of these experiments in August *Gazette* an error occurred in the result of the manurial trial of Farmer's Variety, Gunnedah No 1 Plot. The figures should read:—

	bus.	lb.
No manure	20	20
Superphosphate	21	44
Superphosphate and Potash	21	36

Chou Moellier.

(Marrow Kale)

A. J. PINN, Experimentalist, Hawkesbury Agricultural College.

THIS fodder-plant, which has recently been brought into prominence, is by no means new, as mention is made of it in Morton's "Cyclopædia of Agriculture," published in 1875. It belongs to the Kale or Borecole family of plants, and is characterised by its thick, tall stems and large succulent leaves.

Chou Moellier at Hawkesbury Agricultural College.

The crop grown at this College was sown in drills on the 16th June, 1909, and although the summer of that year was very dry the plants withstood the severe weather conditions without the application of water. Rain fell at the latter end of December, and caused a rapid growth of the plants, which at present (one year after planting) are 5 feet high, and still growing.

During the month of June a small area was harvested, producing a yield of 27 tons 17 cwt. of foliage per acre, and, in addition, 38 tons 18 cwt. per acre of stems.

The best soil for its growth is a warm sandy loam, preferably one that has received an application of stable manure the previous season.

The seed may either be sown in drills and eventually thinned out, or the plants raised in a seed-bed and transplanted into rows 3 feet apart and 2 feet between the plants. On account of the seed being expensive, viz., 5s. per lb., the latter method is recommended. When planted by these methods the cultivator can be used to keep down weeds until the plant becomes sufficiently advanced to need no further cleaning.

If several cuttings of the foliage are required, the large leaves should be pulled from the stem, leaving the younger ones to develop and be of use at a later period. The practice of allowing the crop to remain for more than one season is not recommended. After one year's growth the plants attain a height of 5 to 7 feet, and only a comparatively small amount of leaf is formed at the top.

The crop is especially valuable for poultry, as well as for all classes of stock.

Feeding tests at this College have demonstrated that the foliage is relished by all stock, but the stems are eaten by pigs only.

Besides its value as stock-feed it is also eaten as a vegetable, but only the younger leaves can be used. When prepared for the table it presents a dark-green colour, and possesses a fuller flavour than cabbage.

Although producing a good quantity of feed per acre, it does not possess any special qualifications which would warrant the recommendation of this particular variety before Jersey Tree, or Thousand-headed Kale.

Samples of New South Wales Wheats for American Dry Farming Congress.

The next Dry Farming Congress is to be held at Spokane, Washington, U.S.A., in October. The Department of Agriculture is arranging with the Immigration and Tourist Bureau to send samples of our best wheats, or those most suitable for cultivation under dry conditions, and these are to be despatched per R.M.S. "Marama" on 29th August, while this *Gazette* is in the Press.

The wheats of which samples are being sent are Bayah, Bobs, Bunyip, Cedar, Cleveland, Comeback, Florence, Federation, John Brown, Marshall's No. 3, Medeah, Thew, and Warren. Full notes respecting the varieties are being sent, and the Secretary of the Congress has been asked to present the samples, after the Congress, to Experiment Farms or Colleges in the United States or Canada, provided each recipient sends this Department an equal quantity of his best wheat for dry farming.

Turkeys: In Health and Disease.

[Continued from page 540.]

G. BRADSHAW AND A. L. WYNDHAM.

Turkeys in America.

IN a country with a population of over eighty million people, a large proportion being land-holders, it can be readily understood that poultry of all sorts are extensively cultivated. Just as in this country, and in most other poultry-producing places, fowls are kept in the greatest numbers, followed by ducks, turkeys occupying third place. This arises from the fact that turkeys cannot be raised in confined spaces like either of the two former, and the 2 or 3 acres with a stock of fowls and ducks, which often afford a living to a family, would be utterly useless for the purpose of profitable turkey breeding.

Another flock picture from Wagga Experiment Farm.

However, being a country of large holdings, with a market offering, at certain seasons, a great demand for turkey flesh, they are bred extensively by farmers in every State in the Union; and as the conditions in many parts approach those in this State, some particulars of the system of management adopted by a few of the successful breeders in that great country should be a useful addition to the methods practised here.

It will be noticed that breeders all differ in the manner and nature of feeding and rearing, which is conclusive enough that, just as with other poultry, there are no hard and fast rules either as to food or feeding, everything essential to their growth and development being obtainable on the farm.

American Methods.

A very successful turkey raiser and prolific writer is Mrs. C. Jones, of Compton, Illinois, one of her contributions being as follows:—

The turkey is one of the most profitable of all classes of domestic fowls. They are only adapted to the farmer who has an unlimited range for them, but on such a range they will do an immense amount of good during the summer season by destroying grasshoppers and other insects, turning these into flesh that is always in demand at good prices. It is probable that a pound of turkey meat can be produced on a farm as cheaply as a pound of pork.

At the outset, it must be said that one's knowledge of raising chickens, no matter how extended that knowledge may have been, is not of much value when it comes to raising young turkeys. Their nature and the method of caring for them are so different, that one must learn it as a distinct and separate business from chicken-raising. One may take a brooder full of chickens, and, provided they are well hatched and vigorous, can, by the usual care and attention, raise the majority to maturity, but not so with turkeys. He can hatch the eggs in an incubator with good success, as turkey eggs are usually better fertilised than hen's eggs, but he cannot confine them in brooder runs, and unless he has broody turkeys or hens to mother them when hatched, he may lose the greater portion. They must be given their liberty at a very early age, as the wild instinct, especially in the bronze variety, is so strong that unless given their freedom to roam and forage over fields and pasture, they will sicken and die.

Turkeys are more creatures of habit than any other of our feathered fowl; yet while they will roam over the prairie during the day in search of food, they will always come home at night, if one will make a practice of feeding them, however lightly. We have never been troubled by their staying away at night, for as soon as they return, about sunset, we immediately take a dish of grain, and they follow us straight into their house, knowing they will receive a small ration of food.

Mr. Miller Purvis, one of the best American authorities, says:—

Turkeys require a wide range, as they do not endure confinement, being as yet rather wild in their habits, preferring to seek their feed in the fields rather than to stand around in the farmyard. Where they can have the run of a farm they require but little feed after they are a few weeks old until it is time to fit them for market. They should be fed a little grain each evening to keep them in the habit of coming home to sleep; yet this is not always effective, as they will not come home very regularly at the season when grasshoppers or other natural feed is abundant. The hen turkey seeks a secluded place for a nest, and lays her eggs. After a clutch is laid, she sits four weeks to bring off her young. It is much better to watch the hen turkeys and remove the eggs as fast as they are deposited in the nest. Substitute china nest-eggs for the eggs taken out, until three are in the nest. If the eggs are all taken out the hen is likely to change her nest. If the eggs are removed in this way, the hen turkey will lay two or three clutches in the season, and may be allowed to sit on the last one. The eggs of the first layings may be hatched under ordinary domestic hens, giving a hen seven to nine eggs, according to her size. A single mating with a male will fertilise all the eggs of a clutch laid by a hen turkey.

After the young turkeys, which are called "poults," are hatched, they should be kept for several days in a coop, to which is attached a small run. This should be set on dry ground, and the sleeping part should have a board floor.

Move the coop and run frequently, so that the poults can get at fresh grass. Protect them from dampness and the direct rays of the sun, if the weather is at all warm, as they cannot endure direct sunshine when very young. The poults may be fed bread which has been soaked in sweet milk and pressed as dry as possible by squeezing in the hand. A little fine grit and finely-cracked oats, wheat, and corn make good feeds for them. They like young onion tops cut fine, and these are good for them. Good sweet beef scraps in small quantities are also advantageous. As a general thing copy nature as nearly as possible, never giving wet feed. The wild poult is a seed and grass eater, and there is no advantage in trying to change its habits of feeding when we raise it in the farmyard. Do not overfeed young turkeys. This is very easily done, and leads to trouble. Feed them often, but never more than they will eat with a good appetite. Place finely broken charcoal where they can get at it at any time. This prevents bowel trouble. As the poults grow give them coarser feed, and allow them to run about the place. As soon as the young begin to show red caruncles on the neck, they are saved. That is called "shooting the red," and as soon as the poults begin to shoot the red the owner need worry no longer, as they will then endure any kind of weather.

Mr. B. H. Hislop, of Milford, Illinois, writes:—

The turkey at present is interesting a larger number of poultry raisers than ever before. The reason for this is the great and growing demand for them, and the difficulty in rearing them in large numbers. And, worst of all, it becomes harder each year to raise them in the older settled localities. The breeder who lives near a large cattle pasture, either prairie or woodland (the latter is the better), is fortunate. So is he who lives where there is much land uncultivated. But with us who live where land has passed the 100-dollar mark, and every square foot is under cultivation, the problem of breeding must be solved.

First, the very best, which means the very largest, is what we want, whether for fancy or market. This size we find in the bronze turkey, combined with beauty and vigour. We must start with a good stock, large, it is true, but not birds that have been kept burdened with fat all winter, and which probably have diseased livers and kidneys from high feeding, but birds with good bone, muscle, vigour, and activity. Well-marked plumage, too, we must have, if we wish to cater to the fancy, otherwise fancy markings can be dispensed with. When the laying season commences do not feed heavily, expecting to force a large egg yield, as numbers are not what is wanted. You want eggs with strong germs to hatch strong poults. Take care of the eggs till you are ready to set them, then incubate them any way you please.

Do not try to raise them in any other way than with the turkey hen. Keep them penned up for a time, ten days or two weeks, early in the season. Do not feed the poults for about 48 hours after they are hatched. Then feed sparingly of hard-boiled eggs, stale bread squeezed from sweet milk, chick-feed, mash, etc.; any one or all, but do not neglect the eggs. They can be the infertile eggs from the incubator or sitting hens. We feed a little egg till our poults are able to find all their own food. We tried leaving off eggs one or two years, and used only chick feed, but we found our birds were not as well able to resist the various difficulties of the autumn as when fed correctly when young.

Mr. J. C. Clipp, of Indiana, says:—

I have tried every known plan for feeding turkey poults, and have settled the question in my mind into one way of feeding and managing our poults. The nearer we imitate nature the better success we will have. I have learned not to feed poults but a very little amount of food, and not any until they are at least thirty-six hours old. I prefer turkey hens for mothers; they understand the requirements of the poults much better than the "chicken" mothers. In taking care of the poults I first select a nice large grassy lot, where the grass is short; then prepare a roomy coop, so that the poults will have ample room to

scamper about without coming in danger with the mother's great feet, and being smashed to death. The first feed I give is curd milk. Sometimes wheat-bread softened with sweet milk. But I feed them very limited. Cut onion tops very fine, and mix with soft bread and season with black pepper. I feed this food morning, noon, and night, but in a very limited way, as poults would kill themselves within a week if fed all they will eat, as they have appetites like an ostrich, and will overeat themselves very quickly. The majority of turkeys hatched over the country are killed by overfeeding. Turkey poults will do much better to just turn them out with the mother turkey and let them run at will. I keep grit constantly before them, and if there is no charcoal anywhere near where they run, I prefer fine charcoal for them. They will eat of this very eagerly. If you have range for your poults don't feed them anything except a light feed at night after the poults are three weeks old, and then see that the food is pure. Good, plump, sound wheat is fine for poults. Never feed turkeys stale wheat; wheat that has been damaged from any cause is almost certain death to turkeys. Lice are one of the greatest enemies of turkey poults, and should be watched with a most skilful eye. If you will look between the flight feathers of wings when poults are about four days old you will find them in abundance, as they will run and hide as soon as you disturb them. The long, grey bodied louse you will find on neck, most likely under the throat, on back directly between the wings, and on the body near the vent. Apply a small quantity of lard at night on the poults, and dust the hen well at the same time with some reliable insect powder; the lice will certainly be compelled to vacate for a time at least. Never under any circumstances house your poults or turkeys of any age. Of course, you will be compelled to coop the poults at night until they are old enough to fly up on fences or trees, and then never house them any more. If weather is dry, cold, or even snowing, turkeys will keep much healthier if allowed to roost out in the open. Turkeys are very wild in nature, and must be allowed their wild habits. Feed them but little and keep them free from lice, and you should be able to raise the larger proportion you incubate.

The proper way to carry a Turkey.

A firm of turkey growers, G. A. Kayner and Co., of New York, give their experience as follows:—

The thoroughbred Mammoth Bronze and White Hollands are our favourites. There are, however, several other varieties of thoroughbred turkeys that are almost as profitable for market purposes as either of the abovenamed, but not as an all-round money-maker for the farmer and fancier. It is noticeable upon going at holiday-time into a car of market turkeys coming from any of our turkey-growing States that about three-fourths of them are Mammoth Bronze, or have a large portion of that blue blood in their veins; the remainder often being a few of every known variety.

The White Hollands are not as old a variety as the Mammoth Bronze, yet they occupy second place in the industry, and are rapidly coming to the front. Were we to be confined to any one breed, it would certainly be the oldest, largest, and most profitable of all—the Mammoth Bronze.

The management of our breeding stock is the least of our trouble on our farms. They roost in the trees all the year around, and run at large whenever they please except during the breeding season, when they are confined to an orchard, surrounded with a poultry fence six feet high,—all birds having one wing clipped close to keep them from flying, ladders being used for them to ascend into the trees at night. Our object in yarding them at this time is that we may get every egg. They invariably deposit their eggs in sugar barrels placed in a pleasant secluded spot prepared for that purpose. If one should by accident get out she will try hard to get back rather than run away after having laid an egg or two.

The entire flock are fed on corn and oats—about one part corn and four parts oats, night and morning, with all the cabbage or apples they want during the day as a green food. Grit is at their disposal at all times. During the breeding season they have animal meal occasionally, pure water every day, and stale bread soaked with milk or water for one feed, instead of corn and oats, sometimes giving them a change of wheat or buckwheat.

We have never used any artificial means of incubation, and never will for hatching turkeys; if we had space we would relate some of our sad experience in this line. The turkey hen is second to none as an incubator and brooder. We gather eggs from breeding yards daily, placing them in a cool, dry place, turning every few days, or changing from one basket to another. When we find a broody hen we put a sugar barrel in some secluded spot facing south, putting in a small bedding of fine straw or leaves, after which we place the eggs in the barrel; the number of eggs to be governed by size of hen, but never to exceed fifteen. About dark we get the broody hen and slip her on the nest, after which we cover the front of the barrel.

About the twenty-eighth day we prepare a large light coop in which to put the contents of the sugar barrel. After the family have settled in their new quarters we give both hen and little poults all they will eat of stale bread soaked in milk, three times a day for three days, after which we allow them to run at large, unless the weather should be very unfavourable. Caring for them in this way, letting them have free range after the fourth day, we are never troubled to any great extent with lice, and as we are never in a hurry about getting our young out of the shell, we avoid the heavy spring rains which prove so fatal to young turkeys.

Mr. E. Shieber, of Ohio, contributes as follows:—

I think the White Holland the most beautiful and most profitable of all turkeys. They do not attain the size of the Bronze, but they are much easier raised, mature quicker, and the young will weigh as much at Thanksgiving as will Bronze of the same age.

In the White Holland turkey you not only have a good table fowl, but you have something very beautiful. There is nothing more pleasing to the eye than a large flock of White Hollands roaming over the green fields of the farm.

I give the breeding stock free range, feeding them night and morning in the winter; but in the summer they prefer to hunt their own living, especially in the morning, and they need but little feeding during the summer months.

The best method of hatching the young is with the turkey hen, setting her in the nest where she laid. It is a good plan to set two hens at the same time (then the two litters can be given to one hen); and it is the best to keep the little ones in a pen made of boards high enough so that they cannot get over them for a week or ten days, after which they usually do best with free range. The pen for the young should not be made on grass, but a dry spot bare of grass should be selected, and some sand or fine gravel thrown on it.

Oatmeal is a very good food for little turkeys, and a little should be scattered all over the pen, as they like to pick a little, go a few steps, and pick some

more. They seem to want to exercise when taking a meal. A little hard-boiled egg also should be fed while the poults are penned up. Cracked wheat, cracked corn, onion tops, &c., should be fed alternately. Feed four or five times a day while they are penned up, but after giving them free range (which should be when about ten days old), feeding twice a day will be sufficient.

Keep them penned up in the morning until the dew is off the grass, as they cannot stand much wet until well feathered. When feathered they are very hardy, and can endure almost any kind of weather.

According to my experience, they are the most profitable kind of poultry The feed bill during the summer and fall months is small, for all this time they are living on grasshoppers, bugs, insects, weed and grass seeds, &c., and in this way they are a great help to the farm, keeping down insects injurious to crops. I think that, summing it all up, turkeys are a little in the lead as profit makers.

The next section will deal with turkey-breeding in Australia, and will give the methods adopted at Wagga Experiment Farm.

(*To be continued.*)

Inspection of Canned Meat by British Board of Trade.

It may not be generally known by those in the meat-canning trade that a very close inspection is made by the British Board of Trade Inspectors of all tinned meat; and in order to avoid condemnation and subsequent loss, it is always advisable that very great care be exercised by packers when preparing meat for canning.

There are certain standards to which the Board of Trade Inspectors adhere, and consequently tins of beef containing scrappy meat and an excess of fat will generally be rejected.

It is necessary also that the pack should not show signs of unequal quality. This term is meant to convey the necessity for uniformity. For example, suppose one dozen tins are opened. Of the lot, perhaps two may contain fine grade meat, three others only just reaching the standard required by the Board, and the balance showing various defects, such as metallic action, bone, or other bad faults. The parcel will not be passed.

The Board of Trade Inspectors of ships' provisions object to any bone whatever in tinned meat, and however small a quantity of bone may be present in the tin, it will preclude the Inspector from passing the goods for use as ship's stores. As large quantities of tinned meat are bought in Britain for ship's stores, it is apparent that packing firms require to be most careful in supervising the quality of meat packed for shipment oversea, as very considerable loss and much dissatisfaction must arise if at any time the purchasers of canned meat find the article condemned by Board of Trade inspectors.

H. V. JACKSON.

H. S. BURTON LIT

SCALE-EATING LEPIDOPTERA
(THALPOCHARES SPP.)

E. H. ZECK DEL

Scale-eating Moths.

WALTER W. FROGGATT, F.L.S., Government Entomologist.

AMONG the moths we have, in the larval or caterpillar state, some of the worst insect pests that the gardener and farmer have to fight, and with very few exceptions we may class the moths as pests, whenever they become abnormally abundant. The same applies to some of the butterflies. As some of the exceptions, however, we find a very interesting group placed in the Genus *Thalpochares*, which are carnivorous in the caterpillar state, and feed almost exclusively upon *Coccidæ*, scale insects which do so much damage to plants. The members of the genus have a wide range, and though only one European species has been recorded with similar habits, all the Australian species are endowed with this carnivorous instinct.

Mr. George Masters was the first to call attention to the little moth larvæ feeding upon the scale infesting a *Macrozamia* in the gardens at Elizabeth Bay. The caterpillars are now known to be a great factor, in their native state, in devouring the white scale (*Eriococcus coriaceus*) upon the young eucalypts, and more recently have attacked the brown olive scale (*Lecanium oleæ*) particularly upon the citrus trees, in some districts almost freeing the trees of this pest. This moth was named *Thalpochares coccophaga* by Mr. Meyrick, in allusion to its scale-eating habits.

The handsome little brown and grey moth lays her eggs among the scales upon the foliage and branchlets of the infested tree, from which the tiny caterpillars emerge. After first feeding upon the larval scale, the caterpillars afterwards attack the adult scale, at the same time constructing with silken strands and the skins of the coccids devoured, a box-like covering, open on the under-surface, so that they can crawl freely about with a protective tortoise-like shell covering upon their backs. As they are soft, white, naked little larvæ, this is their sole means of protection.

When these caterpillars are full grown they attach their protective coat to the twigs, and, sealing it up on the under-side, convert it into a regular cocoon. On a tree badly infested with scale, where these caterpillars have been feeding, one will notice, mixed up among the scale insects, much larger irregularly rounded lumps that might be taken for very large coccids, until they are examined and the conglomeration of bits of coccids noted.

On examining the saltbush scale in 1892, Olliff found that it was infested with a new species of this genus, which he described under the name of *Thalpochares pulvinariæ*, from the generic name of the scale *Pulvinaria Maskelli* upon which it was feeding. He gave an account of these useful moths in this *Gazette*, Vol. IV, 1903, illustrated with the beautiful plate now reproduced.

I have since bred another delicate pearl-white species, *Thalpochares dubia*, from another western scale, *Ingilisa forminifer*, and also from a *Lecanium*, upon the cultivated fig. A fourth species, *Thalpochares pusilla*, one of the smallest, has been described from Australia with the same habits.

[EXPLANATION OF PLATE. SCALE-EATING LEPIDOPTERA.

Fig. 1.—Branch of Peach-tree affected with Black Scale (*Lecanium oleæ*, Bern.).
,, 1*a*.—Scale-eating moth (*Thalpochares coccophaga*, Meyrick), greatly enlarged; 1*b*, the same in resting attitude; 1*c*, the same, natural size.
,, 1*d*.—Pupa or chrysalis of same (enlarged); 1*e*, Larva or caterpillar of same (enlarged).
,, 2.—Twig of Saltbush, *Rhagodia hastata*, affected with Saltbush Scale (*Pulvinaria Maskelli*, Olliff), natural size.
,, 2*a*.—Scale-eating Moth (*Thalpochares pulvinariæ*, Olliff), greatly enlarged.
,, 2*b*. Larva or caterpillar of same (enlarged).
,, 2*c*.—Cluster of dead Scale-insects concealing the pupa or chrysalis of the moth.

C

Moree Irrigation Farm.

OPENED SEPTEMBER, 1899; CLOSED MAY, 1910.

A. E. DARVALL, late Manager.

THE Moree artesian bore, one of the earliest in the State, was put down under the supervision of the late Mr. J. W. Boultbee, Superintendent of Public Watering Places. He was a firm believer in the benefits to be derived from irrigation in our semi-arid district, and was responsible for a certain area of land, subdivided into small paddocks, being reserved near the sites of both the Moree and Pera bores, on which he hoped to found small irrigation settlements which would supply the surrounding districts with fruit, vegetables, and forage, and incidentally enable numerous families who had not enough capital to go in for farming or pastoral pursuits on a large scale, to make a comfortable living. Unfortunately, however, probably because he was unable to get the right kind of settlers with the necessary knowledge of irrigation, the result was in each case a failure.

The idea was excellent. Each settler was to rent his land at something like 13s. 4d. per acre per annum, which included a supply of water, at the rate of 18,400 gallons per diem per paddock of about 13 acres, to be delivered at the highest point of the paddock, whence it could be led by gravitation to any place that it was required. The leases were for twenty-one years; or if resumed by the Government within or at the expiration of that time, any improvements were to be taken over at a valuation.

In order to encourage these proposed settlers, and to show them how crops should be grown under irrigation, small Experiment Farms were opened at each of the bores. Thus in the Annual Report of the Department of Agriculture for 1899 we find the first mention of the Moree Farm. It says:—

> . . . . . The land at Moree Bore, where a small Experimental Farm was established in September last, is typical of a large tract of very rich black soil, that in consequence of its gluey nature is exceedingly difficult to cultivate. The productiveness of the soil is wonderful, and Mr. Thompson, the manager, will devote his attention to experiments with the object of ascertaining methods by which such land can best be treated to overcome the mechanical difficulties that now debar its fullest utilisation.

This small paragraph relates briefly the object for which the farm was established, and it may safely be said that since it was written a great deal has been learnt from both the success and the failure of various experiments, as regards the working of the soil and the crops that have been tried in it; for every failure made on an Experiment Farm is as valuable, to the man on the land, as a success, provided of course that the reason is discovered for that failure, and that it is used as a stepping-stone to ultimate success. A single failure, the cost of which is borne by everyone in the State, is not

very expensive; whilst the same failure made by, say, even fifty farmers, would represent a large sum of money in seed and loss of produce from the area on which the crop was sown.

Lessons from the Black Soil.

As an example, take the attempts that have been made at Moree to "ascertain the methods by which such land can best be treated to overcome the mechanical difficulties that now debar its fullest utilisation." Nothing has been said about these in print, but a glance through the implement shed of the farm tells its tale. First we find an ancient wooden roller with spikes in it, and can well imagine that it was not used many times. In dry weather the clods would not be affected by it in the very least, and when the ground was moist the roller would gradually increase in circumference until it jammed against the framework. Next in appearance of age we have an old wooden-framed disc harrow, which would have much the same fate as the roller. Last of all we have a sled-like implement called a "clod crusher," built of 2 in. by 8 in. spotted gum planks set like weatherboards, each being sheathed along the edges with iron. A man stands on this and drives the team. Theoretically the iron-bound edges should pulverise the clods, but in practice it simply bounds over them and gives the driver a rough time. All these implements cost money, and their trials time. The crops also would either not be put in or would suffer from the bad tilth of the ground. But each failure was so much additional proof that this particular variety of soil could not be worked in the same manner as the lighter soils, and could not be got into good condition by the use of implements; and that, to state the facts briefly, as soon as a crop is taken off the land should be ploughed and left to weather down ready for the next. For late autumn and winter sowings the ground should be ploughed before the end of December, in order that the monsoonal rains, due in January, February, or March, may penetrate well into the subsoil and be stored there, and at the same time break down the clods and leave the ground in good condition for the seed which will be drilled in in April. By this method enough moisture will be stored in the soil to germinate the seed and to carry the young plants through the winter months, which are often dry ones. A full description of this practice will be found in the *Agricultural Gazette* of January, 1909

Irrigation.

The farm having been originally intended to be an irrigation one, it will be as well to deal with that subject first. In this country there seems to be a certain amount of prejudice against irrigation, which will disappear as the country becomes more thickly settled. At present the pastoralist is quite content to allot 2 to 2½ acres to support one sheep, which, at a liberal estimate, brings in a gross return in wool and increase of 12s. 6d., or 6s. to 6s. 3d. per acre per annum. The same land under ordinary cultivation would probably bring in a gross return of at least £4 per acre. But closer settlement, which means smaller areas and less reserve pasture to fall back upon, will mean that the land will have to be worked to its fullest capacity, and that

the natural rainfall, which cannot be depended upon, will in case of emergency have to be supplemented by irrigation. A careful system of cultivation on the lines of the so-called dry farming principle will to a certain extent conserve the moisture in the black soil, but five or six weeks without rain will cause it to crack in spite of all precautions, and the rate of evaporation increases enormously.

One of the most plausible arguments brought forward by the opponents of irrigation is that stock will not eat fodder that has been grown under irrigation. They are quite sincere in making this statement, and in many cases quite right; but this is the exception that tests the rule, for the forage grown under irrigation that is unfit for stock to eat has had too much water, causing its growth to become rank. Now stock do not like rank vegetation of any kind, whether grown artificially or naturally—*i.e.*, by over irrigation, or as the result of a very wet season—and the result is that the blame for the mistake made by the inexperienced irrigator has to be borne by the system.

All tropical vegetation is rank. The tropical climate is moist and hot. Our climate on the north-western plains is for eight months in the year, to put it mildly, warm. If to this we add sufficient moisture by repeated irrigations, we practically make a little tropical climate of our own, and to come back to our starting point, get a tropical growth of vegetation, which is rank and unfit to feed to stock.

Crops intended for hay, ensilage, &c., should be sown thickly—*i.e.*, over a bushel per acre when put in with a drill, and proportionately more when sown broadcast. Water should only be applied when the crop shows signs of requiring rain. This should give a crop with finer straw and a larger proportion of head to it than would be obtained by a thinner sowing and over irrigation, which would result in a tall coarse straw, altogether out of proportion to the head, and unfit for feed.

The water from the strata or water-bed from which this bore draws its supply, seems to have little if any evil effect upon the black soil. This to a certain extent is due to it (the soil) containing about 1½ per cent. of lime, whilst the water itself does not contain as much soda or salt as many of the other bores. The result is that 3 tons per acre of oaten hay have been taken off a paddock that has been under irrigation for the last eight years; whilst excellent crops of wheat, maize, and sorghum have been grown in paddocks that have been under irrigation for about the same period.

The simplest and most effective method of applying the water, as far as we know at present, appears to be by a system of parallel furrows about 8 feet apart, running through the paddock down a gradient of 12 to 18 inches in 10 chains. This soaks away underneath the ground, making it moist without puddling the surface. This was fully described in the *Agricultural Gazette* of February, 1910.

With part of his land under irrigation, the farmer can not only be sure of escaping the worst effects of a drought, but he can grow crops that otherwise he could not attempt to raise under the ordinary conditions in this district; such, for instance, as maize, sorghum, and lucerne, with which we will now deal.

Maize Trials.

Variety trials of maize were commenced last summer, and the results, which are given below, are distinctly encouraging when one takes into consideration the fact that the paddock in which they were carried out was not in a good state of cultivation, owing to its having, until a comparatively short time ago, been laid down in Couch grass. This has not been entirely eradicated, and caused bare or stunted patches at intervals throughout the whole crop. Moreover the soil, having been irrigated by flooding for some six years or more, is still in a bad mechanical condition. The fodder weights were not taken, but the difference in the growth was very noticeable, Marlbro' Prolific averaging about 10 feet in height, Cocke's Prolific 8 feet, whilst Funk's Boone County Special and Funk's Yellow Dent only run a little over 5 to 6 feet, although the latter gave by far the best return of grain. As a fodder crop, Iowa Silvermine, which has been grown on the farm in previous years, compares very favourably with, if it is not superior to, any of the above varieties.

It must be noted that no fertilisers were used in these trials.

Maize.

No. 1.—Funk's Boone County Special.

Sown, October 2 and 4, 1909.
Irrigated, October 5 and November 19, 1909.
Picked, March 26 and 29, 1910.
Area sown, 1·66 acres.
Yield, 12 cwt. 0 qr. 24 lb. = 24·4 bushels.
Yield per acre, 14·69 bushels.
Height of growth, about 5 feet.

No. 2.—Funk's Yellow Dent.

Sown, October 4, 1909.
Irrigated, October 6 and November 20.
Picked, March 24 and 25, 1910.
Area sown, 1·66 acres.
Yield, 18 cwt. 3 qr. 11 lb. = 37·7 bushels.
Yield per acre, 22·71 bushels.
Height of growth, about 5 feet.

No. 3.—Marlbro' Prolific.

Sown, October 4 and 5.
Irrigated, October 7 and November 21.
Picked, March 30 and 31, 1910.
Area sown, 1·66 acres.
Yield, 15 cwt. 3 qr. 7lb. = 31·6 bushels.
Yield per acre, 19·03 bushels.
Height of growth, about 10 feet.

No. 4.—Cocke's Prolific.

Sown, October 5, 1909.
Irrigated, October 8 and November 22.
Picked, April 1, 2, and 4, 1910.
Area sown, 1·66 acres.
Yield, 12 cwt. 2 qr. = 25 bushels.
Yield per acre, 15·06 bushels.
Height of growth, about 8 feet.

The value of the varieties for green fodder appears to be in the order 3, 4, 1, 2.

Sorghum.

Sorghum grows luxuriantly, and was used by Mr. W. R. Fry in some sheep-feeding trials which he conducted in 1905, the results of which were published in the *Agricultural Gazette* of August, 1906, and are now incorporated in Farmers' Bulletin No. 33. In connection with these trials it must be pointed out that they were conducted with the purpose of proving, not that sorghum was the most suitable food for sheep, but that sheep could be carried through a fairly long drought by crops grown under irrigation and on a small area when the number of sheep to be fed is taken into consideration. It is stated by some people that the sheep were in worse condition when taken out of the paddock than when they were put in. This is open

to argument; what there is no doubt about, is that they not only lived but came through the trial little if any the worse, whilst supposing there had been a drought, a hundred times the area that supported them under irrigation would not have even kept them alive without it.

Lucerne.

As regards lucerne, it is doubtful whether it will ever be a profitable crop to grow on the black soil for hay, as irrigation brings the couch into the paddocks very quickly; but as a rotation crop, to give the land a rest and provide good grazing for, say, about three years, it is invaluable. The first growth in spring and the last in autumn can generally be got into the hay-shed in good condition. For the rest of the summer the heat is too great, and no matter how expeditiously it is got in, a lot of the leaf is lost. Nevertheless there should be a paddock of it on every station to provide nourishing food for the various cattle, or for topping off sheep or other stock. Great care must however be taken not to let stock graze on it for too long a time when first turned in, or when it is wet with dew or rain. Twenty minutes or half an hour is quite long enough at first, and then they should not be very hungry; otherwise they are sure to get blown.

Fruit.

The orchard, a purely experimental one of a little over 3 acres, is also under irrigation, but the results, as far as the deciduous trees are concerned, with perhaps the exception of pears, which should be grafted on their own stock, quinces and walnuts, have not been satisfactory. However, the orchard having suffered several set-backs from various causes, it is not absolutely certain that good fruit cannot be grown. Grape vines, including table varieties and sultana raisins, have also been tried. They do very well as regards growth and bearing, but owing to hailstorms and monsoonal rains, which are prevalent just about the time when the crop is maturing or ripe, it is very seldom that the grower can rely on marketing his crop in good condition. On the other hand, citrus trees do well, bearing very good crops of finely-flavoured fruit, the oranges especially having thin skins of a nice colour and a generally attractive appearance. Amongst the different fruits tried, besides oranges, are mandarins, lemons, limes, Bengal citrons, grape fruit, and olives. The lastnamed do exceptionally well, and yield a good oil. They are grown extensively on the same class of soil in California, and it seems to suit them admirably. At the present price of olive oil, 14s. per gallon, there appears to be an opening for a very profitable industry. The orchard was not troubled at all with white ants, except in the immediate neighbourhood of a hardwood fence. Anyone planting an orchard should make a note of this, and either have the surrounding fence posts of iron, concrete, or some material that will not harbour this pest, or else leave a wide, clear space between the fence and the nearest trees. In any case the latter is desirable, in order to leave room for the team to turn comfortably at the end of the rows when scarifying the orchard.

Dry Farming.

Now, as regards the dry area, as has been the case in Riverina and other wheat-growing districts in former days, it is confidently stated—by pastoralists—that wheat cannot be grown profitably on the north-western plains. But experiments have now been carried out for some years in a 25-acre paddock which is never irrigated, conclusively proving that, given the average rainfall for the Moree district, which is about 25 inches, profitable crops of wheat can be grown, provided that the ground has been got into proper condition before the sowing season, and that only suitable varieties of wheat are planted. Comeback seems to be the most suitable, whilst Warren, which was tried for the first time last year, appears to give an equal return of grain and a better return of hay. As this is only the experience of one season, however, it cannot be confidently asserted that it will be a success. Both of these varieties are very rust-resistant. This was specially noticeable last year, when there were practically clean plots of Comeback, which was the variety used for check plots, standing between plots of other varieties that were red with rust.

Mr. G. L. Sutton, State Wheat Experimentalist, in the Annual Report of the Department for the year ending 30th June, 1909, says :—

It is specially worthy of record that, in a general way, very satisfactory results have been obtained from the dry area at Moree.

The variety Comeback was used as a standard in the check plots. Its yield of grain was at the rate of 23¼ to 30½ bushels, and its yield of greenstuff from 4⅝ to 5¼ tons per acre. These results, obtained with a rainfall for the year of 2,687 points, and during the growing period of 839 points, indicate that this stubborn black soil is suitable for profitable cultivation with rational systematic treatment, and under such treatment is capable of producing grain of the very best quality, as is shown by the following milling analysis of a sample of Comeback grown under natural conditions. For the purpose of comparison, the milling analysis of a sample of Manitoba wheat, which is the standard wheat of the world, is also given.

At the same time that the wheat referred to above was sown, another 2¼ acres of the same seed, Comeback, was sown in one of the irrigated paddocks. It received three irrigations, viz., immediately after sowing, when half-grown, and finally when heading out. It yielded 36·6 bushels per acre, and a sample was sent to be milled, together with the Comeback from the dry area. Its analysis is added to those given by Mr. Sutton, in order to show how irrigation, judiciously applied, will increase the yield without spoiling the quality of the grain to any appreciable extent.

	Weight per Bushel.	Flour. Per Cent.	Strength. Quarts per Sack.	Colour.	Dry Gluten.
Comeback, dry area, Moree ...	63	69·5	59·4	Good	14·58
Imported Manitoba	63¾	70·0	51·2	Excellent	12·37
Comeback, irrigated, Moree ...	64¾	71·6	55·0	{ Good Chalky*	12·40

* As compared with Manitoba.

When it is remembered that the above results were obtained without the use of fertilisers, on land that was by no means virgin soil, it seems probable

that before many years have passed this will have become one of the best wheat-producing districts in the State, and that when, as must inevitably happen, the rivers are locked, their waters stored, and made available for irrigation, instead of, as at present, running to waste, crops will become a certainty instead of a probability, and much larger returns will be obtained in any case.

The two grasses that have been tried are Rhodes and Paspalum, both exotics. The former seems to be very suitable for dry, hot districts, and from reports to hand from those to whom roots have been sent, appears to do well in any soil. Full details of this grass appeared in the August, 1909, number of the *Agricultural Gazette.*

Paspalum, on the other hand, does not seem to thrive in dry districts, but possibly it might do better under irrigation. It seems probable, however, that it will not be a success at any great distance from the coast.

Skinless barley has been grown each year on the farm to provide green feed for the horses in the winter. For this purpose it is invaluable, and a few acres of it should be sown on every farm. If sown fairly early in March it is as a rule ready to cut by the time that the frosts have killed the natural grasses. Two cuttings can be taken off it, or the second growth allowed to head out for grain.

Cotton was tried by Mr. W. R. Fry, at Moree, and the results are embodied in an article written by him for the *Agricultural Gazette* for May, 1908.

Root crops and vegetables, owing to scarcity of labour, have not had a fair trial, but it can safely be said that deep-rooting tubers, such as potatoes and Jerusalem artichokes, will not do well in this stiff clay. On the other hand, mangolds and turnips do well, as they can expand above ground. The latter are seriously troubled by aphis, but the former can be recommended as worth being given a trial by sheep men. They seem to stand the climate well, and the soil appears to be suitable for them.

Broom millet was grown here successfully by Mr. Fry, under irrigation, a very good sample being obtained. This may in future years be a source of income to small selectors.

Why the Farm was Closed.

The following extract from the Annual Report of the Under Secretary of Agriculture for the year ending 30th June, 1909, foreshadowed the winding-up of the farm:—

At Moree we seem to have reached the fullest extent of experimental work possible, and there is no room for applying the practical lessons on any large scale. The demand for water during the hottest months of the year on behalf of the town, the requirements of the baths and of the other lessees who have rights with regard to the water in the matter of wool-scouring, and irrigating certain areas of land adjoining the farm, all tend to minimise the operations of this small station. If it be decided to start work on a demonstration area of considerable size near Coonamble, where a bore will have to be used for the water supply, the experience that has been gained at Moree by the operations, first of Mr. Fry, and later, of Mr Darvall, will be invaluable; but there will be no need to carry on any further experimental work at this place. The pastoralists who have experienced the ill effects of bore water have not been convinced by the results of our work at Moree, for the simple reason that the water from this bore is much less alkaline, and therefore less injurious to plant life than many of the waters from other

bores, and it has frequently been urged that we should extend our experimental work to some alkaline waters which are at least doubly as strong in salt and carbonate of soda as the water from this one.

The latest analysis of the water from this bore shows a distinct diminution in the amount of alkaline constituents.

The composition of the respective waters from bores in the Moree and Coonamble districts is given hereunder, and it will be seen therefrom that the problem to be faced in dealing with the application of such water to the black-soil plains of Coonamble is more difficult, and therefore more worthy of our best endeavours, than that which we have to deal with at Moree :—

	Grains per Imperial Gallon.	
	Sodium Carbonate.	Sodium Chloride.
Moree	39·259	7·029
Coonamble, Ottendorf I.L. 1,201	51·407	20·679

Samples of N.S.W. Wheats sent to England.

At the time of the recent Royal Agricultural Society's Show, the Premier approved of the purchase by the Immigration and Tourist Bureau of some of the prize-winning exhibits of wheat for despatch to London, provided the Department of Agriculture could certify that the wheat was of high class. Arrangements were accordingly made, and nine bags of wheat were forwarded to the Agent-General for exhibition in England.

The following were the wheats sent:—

Class.	Catalogue Number.	Variety.	Exhibited by—	Prize.
711	4560	Medeah	W. G. Reinhard	1st.
712	4564	Manitoba ...	do	1st.
712	4563	do ...	D. McMillan	2nd.
713	4585	Bobs	Smith Pollock	1st and Champion.
713	4590	do	Towri Estate	2nd.
714	4607	Jade	Geo. Lindon	1st.
714	4606	Bunyip	do	2nd.

As none of these wheats were of the variety Comeback, which it was desired to exhibit, two very good samples of this variety, though not prize-winners, exhibited by the Towri Estate, were also forwarded, viz., Class 713, Catalogue Nos. 4589 (Comeback), and 4591 (Towri Comeback).

The wheats were forwarded per s.s. "Mooltan," on 7th May last. The Director of the Immigration and Tourist Bureau has been advised by the Agent-General that the wheat is being displayed at Liverpool, the Corn Trade Association having offered facilities for placing it in a position where it will come under the notice of millers and buyers. The grain is also being shown at the Baltic Exchange, and a sample placed on view at the Agent-General's office. The trade journals have been approached to give publicity to the exhibit.

For the purpose of judging, these wheats had already been milled, and the milling reports and analyses were forwarded with the samples. Further information respecting these wheats will be found in Mr. Guthrie's article on "Wheats at R.A.S. Show," *Agricultural Gazette*, July, 1910, page 599.

Batlow District.

H. ROSS, Inspector of Agriculture.

BATLOW is situated 15 miles by road from Gilmore, 20 miles from Tumut, and 18 miles from Adelong. As an agricultural district Batlow has not come into prominence until a few years back, but lately land seekers, especially intense culturists, are beginning to realise the immense potentialities of this district.

Fig. 1.—A New Settler's place, Batlow District.

Red basaltic soil, ranging in depth from 8 inches to 2 feet, over a heavy clay subsoil, with occasionally black patches of alluvial deposits, are the characteristics of the surrounding country. The timber, gigantic in its proportions, consists of messmate, white gum, stringybark, and mountain ash. Already two sawmills and factories are in existence, one at Laurel Hill, the other at Pilot Hill, respectively 10 and 14 miles distant from Batlow township, manufacturing sculling oars, pick handles, axe handles, &c., from

mountain-ash timber. It is, however, not from a saw-miller's or manufacturer's, but entirely from an agriculturist's point of view that this article deals with the district.

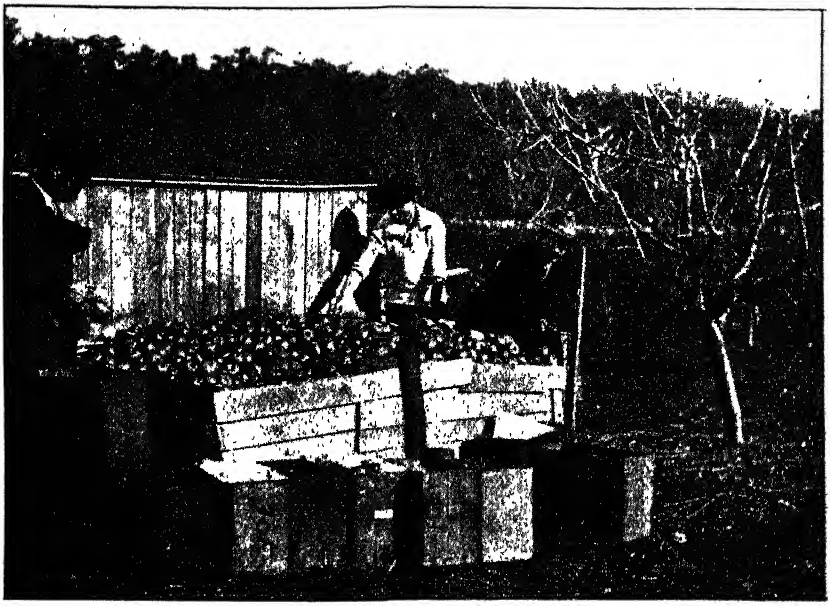


Fig. 2.—Packing Apples for market, Batlow District.

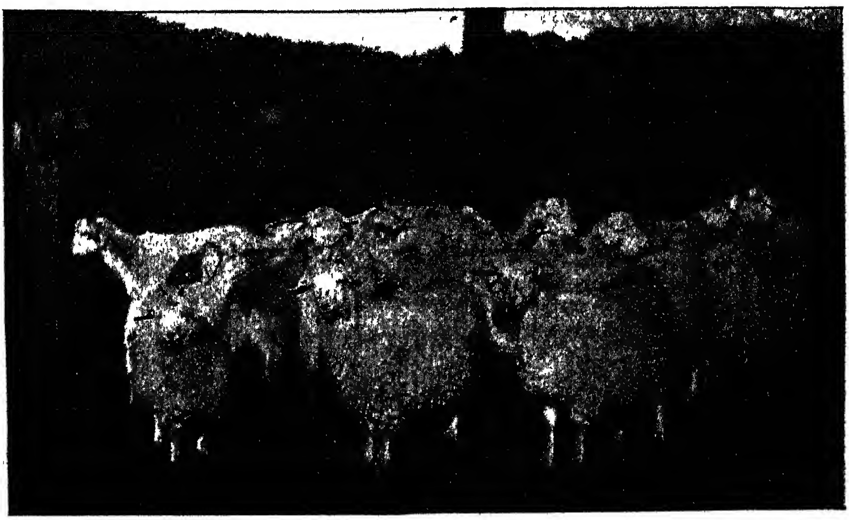


Fig. 3.—Angora Goats "May Day," Batlow.

They keep down the undergrowth and new shoots of trees in newly ringbarked paddocks.

Productivity of the Land.

As a fruit-growing and potato-producing district it would indeed be difficult to name many localities in the State which can offer the same advantages as regards quality of soil, cheapness of land, and certainty of rainfall. Pears, prunes, apples, gooseberries, raspberries, cherries, strawberries, peaches, apricots, and walnuts grow to perfection. Instances are on record where £90 worth of "Winter Cole" pears have been harvested from 1 acre, and where 3 acres of prunes have yielded over £200 worth of fruit. Of course these figures must not be accepted as an average return, but it is considered that pear and prune trees in full bearing will average £40 per acre.

Fig. 4.—Pruning Raspberries, Batlow District.

In the background may be seen some of the land in its virgin state.

Potatoes grow remarkably well, yields of from 7 to 10 tons per acre having come frequently under my personal knowledge.

Price of Land and Cost of Clearing.

The land, as mentioned before, is thickly studded with various kinds of timber. In its virgin state it can be bought for £1 per acre. Partly cleared

and with all the timber ringbarked, it is available for £3 to £3 10s. per acre according to locality. The cost of clearing this ringbarked country is from £3 10s. to £4 per acre, thus making the total cost of land fit for the plough from £7 to £7 10s. per acre.

About 5,000 acres of this class of country are in the immediate vicinity of Batlow, and more than 60,000 acres between Batlow and Laurel Hill.

Fig. 5.—Sun-drying Prunes, Batlow District.

Record of Rainfall, 1900–1909.

Year.	Inches.	Year.	Inches.
1900	55·71	1905	45·10
1901	41·91	1906	49·33
1902	42·14	1907	49·20
1903	71·75	1908	46·40
1904	47·58	1909	54·42

Total for ten years ... ... 503·54 inches.

From the above figures it will be seen that the average annual rainfall is over 50 inches.

Methods of Cultivation.

Fig. 6.—A giant, even among Batlow timber.

The usual method employed by new settlers in the district is to clear from 10 to 15 acres the first year, and to immediately put the cleared area under potatoes. The first year's produce from these will invariably prove to return to the settler more than the initial cost of purchase of land, cost of clearing, ploughing, and putting in crop. The second year, a start is made planting fruit trees — still growing potatoes in between the trees—and clearing another 10 acres for next season, and so on. Potatoes are grown in the orchard between the fruit trees until these begin to bear freely.

A typical case of the possibilities in this district came under my notice lately. A settler took up a block of 60 acres He cleared about 20 acres the first year, and put in potatoes in November, 1909. The resulting crop was a yield of 7 tons per acre, which, at time of digging (May, 1910), were worth £5 per ton *at Batlow.*

It will be found that from 40 to 60 acres is a sufficiently large area for any one man and his family to look after. Only a small capital is required to make a start, and I venture to say that there are not many districts in the southern part of this State where a man with limited means can make such a reasonable certainty of success as he can in the Batlow district.

Cheesemaking versus Buttermaking in Australia.

From a Farmer's Point of View.

MATTHEW WALLACE, Dairy Instructor.

AUSTRALIA can hardly be described as a cheese-producing country, at any rate not in the sense that Canada is, and New Zealand is rapidly becoming. Many reasons might be adduced why this is so, but perhaps the real cause is to be found in the fact that in the early history of the country buttermaking was found to be a less elaborate process, and that in the infancy of the dairy industry the profitable demand for butter more than kept pace with the supply.

Another important factor was the opinion at one time widely held, that the summer heat was too great for the production of good cheese. This, however, does not interfere with the principles of cheesemaking, though it makes success dependent upon our ability to control those conditions, as they are met with.

That there is a good demand for this commodity is plainly evidenced by the fact that very little of the total cheese produced is exported from the Commonwealth, whilst a quantity of New Zealand cheese is consumed here, and until lately some American and Canadian cheese, chiefly put up in pots, was also imported. I think there is ample evidence before us that cheese of a high class can be manufactured in Australia, and that there is practically an unlimited demand at very remunerative prices.

We have historical evidence that cheese has been an article of diet from very early times; so also has butter. Of the origin of cheesemaking we know very little, but I think it most probable that the earliest cheese must have been some form of compressed curd from milk, which had become sour naturally. Though the keeping of flocks and herds was perhaps man's earliest occupation, it is very doubtful if much or any improvement was made in the cattle for a very long period, or that any system whereby their produce would be spread over the whole year had been devised by those pioneers of the dairy industry; and it is more that probable that the long periods of scarcity led our primitive dairyman to adopt methods of preserving some of the superabundance of the spring and summer, and of storing it away against the lean months of winter. That is the position which cheese in relation to buttermaking will to a considerable extent continue to occupy. In other words, while the production of butter will in all probability continue to be the mainstay of the dairy industry, cheesemaking, while taking its place in some localities, and under circumstances peculiarly suitable for its production, will continue to be a complement of, rather than a substitute for, the allied branch of buttermaking.

I am led to this conclusion by the fact that in Great Britain, still the principal market for the dairy produce of colonial and foreign countries, the production of cheese and butter is generally governed by the circumstances alluded to. It is the practice there for farmers who make cheese at the time of the year when milk is plentiful, to cease making, and dispose of their milk to the cities whenever the price warrants such a step; and others, whose chief business is the supply of milk, at times have to resort to cheesemaking when there is a glut of milk in the market. The factories and creameries, which have now become an established institution in the Old Country, adopt the same methods of regulating the supply of their produce, the net result being a greater financial return to the farmers who supply the milk.

In New Zealand, where the advent of the home separator has rendered superfluous many of the existing creamery buildings, these are in many cases being converted into cheese factories, and it is the opinion of those qualified to judge that cheesemaking has a very brilliant future there.

It is beyond question that at certain periods of the year a much greater return can be obtained if part of the milk is converted into cheese. I refer more particularly to the spring months in Australia, when the supply is at its height and the test comparatively low; and I think the managers of those butter factories which possess in addition a cheese plant will bear out my statement, as will also those farmers who produce cheese at their farms.

Researches recently conducted by Dean, of Guelph, Canada, and Hart, of Wisconsin, have demonstrated that while it is pretty well established that herd milk pretty rich in butter fat is also rich in casein, it does not follow that it is always so, and there is certainly no definite and constant relation between the amounts of fat and casein. One animal may produce milk containing 6 per cent. fat and 2·7 per cent. casein, another containing 4 per cent. fat and 2·7 per cent. casein, and still another containing 3·5 per cent. casein and 6 per cent. fat. Expressed in another way, we have milks which for every 100 lb. fat may contain anything from 46 lb. to 73 lb. of casein. It is clear that a milk containing 73 lb. of casein to every 100 lb. butter fat will produce more cheese than one containing 46 lb. casein to every 100 lb. butter fat. These are not merely hypothetical figures, but taken from actual analysis of the milk from the Wisconsin herd.

I have mentioned these facts simply to emphasise the suitability of certain milks for cheesemaking, and also because of the impression in the minds of many dairymen that cow's milk contains these constituents in a definite and fixed relation; that when the fat increases the casein rises in a fixed and definitely related proportion. This, however, may be or may not be the case; and as a point for discussion I here suggest that just as it is possible to produce dairy cattle which are eminently suited for the production of butter, why not attempt to increase those characteristics of the cow which will make her pre-eminent as a cheese producer? There is room for both. According to Hart, it would be extremely rare to find a herd where the proportion of casein is from 70 lb. to 80 lb. to every 100 lb. of butter fat, but it is certainly

not uncommon to find certain strains and families in dairy herds where it is the rule rather than the exception.

In dealing with this subject from the farmer's point of view we have to bear in mind that cheese can be very profitably manufactured at the farm as well as at the factory; and as the cost of a cheese plant suitable for a farm is well within the reach of most farmers, it is often advisable to manufacture on the spot rather than cart the milk to a factory. The advisability of this course must, however, depend on the circumstances of the locality, the suitability of the buildings, and the milk supply.

It may be of interest to learn that I recently had the pleasure of examining the sale notes of a Victorian farmer, whose return for cheese for the season 1908–9 amounted to £13 4s. per cow on a herd of 75 cows, from a farm of 314 acres. Cheese was made six days of the week, and the milk from Saturday evening and Sunday morning separated The best returns of his neighbours from separating only during the same period was under £10. The dairy buildings in question cost about £140, and the plant between £60 and £70. The output was handled by one young man with some little assistance. I could cite numerous instances of equally good returns obtained by farmers manufacturing their own cheese.

That there exists an almost unlimited market for cheese outside the Commonwealth at profitable returns to the producer is shown by the almost incredible amount of cheese consumed in Great Britain, amounting to over 200,000 tons annually. In addition to the home production, Canada sends over 100,000 tons, and New Zealand over 18,000 tons, the balance being from the United States of America, Holland, Germany, and France.

The principal variety imported is made on the Cheddar principle; and Australia has this advantage, that at the time of production here, all the other competing countries, excepting New Zealand, are in the depths of winter.

The heat bogey need not deter us, as the champion cheese at the Melbourne Royal Show in 1905 was made when the temperature was 110 degrees in the shade. Great heat is certainly very objectionable, but the dry atmosphere of Australia is not nearly so hard to contend with as a moist atmosphere many degrees lower. Personally, I have found 80 degrees more trying in England and Scotland than 103 degrees in Australia.

The relative returns from cheese and butter depend largely on the markets, and the cost of production; but on a general average of the prices ruling, cheese may nearly always be depended on to return more money per gallon of milk during the spring months of the year.

Let us take, for example, milk containing 3·8 per cent. butter fat. It would require, according to calculation, 5,360 gallons of this quality to produce a ton of butter. The manufacturing and marketing of this quantity on the London market costs, according to the balance-sheet of a large Victorian Dairy Company, 1·98d. per lb., equal to £18 9s. 7d. on the

consignment. The average price received was 104s. 9d. per cwt., or £104 15s. per ton. Deducting the cost, £18 9s. 7d., leaves £86 5s. 5d., allowing 3·38d. per gallon for milk, 9·24d. per lb. for butter, and 10·26d. per lb. for butter fat.

The same quantity made into cheese would produce about 5,300 lb. of cheese, which at 56s. per cwt. (6d. per lb.) would realise £132 10s. The cost of making and marketing this quantity on the London market would be about £28 10s. 2d., leaving a sum of £104 to be distributed amongst the suppliers, equal to 4·65d. per gallon of milk, 11·14d. per lb. of butter, and 12·37d. per lb. butter fat. This leaves a margin of ·79d. per gallon in favour of cheese.

The cost of producing and marketing cheese on the London market is approximately 1·3d. per lb., this cost being increased or decreased according to the quantity of milk handled, and the facilities for transit from the factory or farm.

Taking the average price of New Zealand cheese for seven years, 48s. 6d. per cwt., we get a return almost exactly the same as paid for butter during the same period.

In the published account of the meeting of the Dairy Factory Managers' Association last year, the President made the following statement:—"There is considerable room for improvement in the cheese-making branch. It is the exception rather than the rule to be able to purchase good cheese over the counter."

If that is so, and we may take it that, coming from the President, it is substantially correct, I do not think all the cheese of this State carries the reputation which it ought to. We all know the saying, "Give a dog a bad name and you may hang him." Similarly, if once an article gets a bad name, it requires a deal of improvement and uphill work to place it in the position which it ought to occupy.

We want in New South Wales to get not only a good name for our cheese, but to live up to it, and to raise, if possible, the low quality cheese to that of the best.

I have visited shops in Melbourne where one would see cheeses labelled "New Zealand *and other* cheese," and bearing such a family resemblance that one was forced to the conclusion that their place of origin was some Victorian factory.

The Victorian Cheese Expert stated in a paper read before the Victorian Factory Managers' Association in 1907 that he was informed by the secretary of a dairy company that one shop in Melbourne retailed their cheese on two different counters, and by adding the words "New Zealand" the cheese on one counter commanded 3d. per lb. more than the other, though all from the same factory, thus showing that New Zealand cheese has a name which will recommend it.

If we wish to obtain a fair name for the cheese of New South Wales, we must produce an article which will recommend itself; and to do that we must have good men thoroughly trained to their business by competent makers. I

believe such men at present exist, but their numbers are too few. But even this is not all, as no amount of technical or practical skill can entirely undo the mischief which has too often taken place before the milk reaches the maker. Carelessly handled, dirty, or contaminated milk is the bugbear of the cheesemaker, and this is where the farmer can at least do his part. I think managers and instructors cannot too strongly impress upon suppliers the absolute necessity of supplying good milk, as in many cases we saw milk produced under conditions where the most elementary ideas of cleanliness are not realised, and those handling the milk seem entirely oblivious to the fact that they are dealing with a product intended for food, and readily liable to contamination and decomposition.

Cleanliness may be fittingly described as the keystone of successful operations in the dairy.

I do not propose dealing with the details of manufacture in this paper, but would like to mention that the pasteuriser may in many cases be of as much assistance to the cheesemaker as to the buttermaker. From practical personal experience I can say that I have made from tainted milk cheese which commanded the highest price in the Melbourne market for matured cheese, and which, but for the pasteuriser, would only have been of second-rate quality; and the success of two seasons leads me to hope that in the handling of tainted milk the pasteuriser may be of great assistance to the cheesemaker.

I am convinced that most of the failures in cheesemaking are due to inexperience and want of skill on the part of the makers. Cheesemaking is not an art which can be acquired thoroughly by a few lessons, or demonstrations, but requires close study and diligent work on the part of the student; and even after years of experience he will be met with difficulties which are continually cropping up in the course of his work.

We have in Australia a considerable trade in new cheese, and it often happens that makers catering for this class of trade make a cheese which does not mature well, if it should happen to be held over owing to a slackness in the market or from any other cause. What we want is not a cheese which is good only when a month or six weeks old, but one which will remain good if kept to be five or six months old, or even longer. Makers should give this point attention, as they would then be independent of a temporary dulness in the market.

The higher the general average quality of cheese produced, the greater will be the price received. It is the poor quality article which brings down the level of prices. I do not think there is any kind of produce of a high class which is too plentiful, but there is certainly too much low quality stuff, which has often to take the place of a better article. There is profit in good cheese, both for the farmer and for the consumer. What New Zealand is doing we can attempt, even if we do not completely succeed.

Notes on Wheat Culture.

R. J. STOCKS, Linden Hills, Cunningham Plains, Harden.

[During the discussion on dry farming at the recent Wheatgrowers' Conference, Mr. Stocks handed in the following paper for publication in the *Agricultural Gazette*.—ED.]

I WAS farming in the dry northern areas of South Australia for a period of twelve years on an 8-inch rainfall. Fallowing was extensively carried on in the spring months, and the land worked and prepared to conserve the moisture. Although the rainfall was so slight, by systematically farming the land I was successful. However, I decided to transfer my operations to a district with better rainfall, and I succeeded in securing 2,000 acres of the Cunningham Plains Estate, where at present I am farming on the same lines as those which have built up South Australia, and made her one of the leading wheat-producing States of the Commonwealth.

Fallowing.

I advise a system of fallowing every third year. As soon as seeding is completed, should the ground be in good working condition, and all weeds and grass well above ground, fallowing should be started without delay, and discontinued once the grass and weeds come out in ear. Plough the fallow to a depth of 4 or 5 inches. Much depends on the nature of the soil. Never turn up the clay subsoil to any extent. See that the furrows are well packed.

I am using three 6-furrow latest improved stump-jump ploughs, cutting 8 inches each furrow, and they are giving every satisfaction. Harrow all the fallow before the land sets, and repeat the operation after rain during the summer.

Later on I hope to have some useful information on the subject of rotation of crops.

Pickling Seed Wheat.*

One pound of bluestone (best) thoroughly dissolved in 6 gallons of water, will treat 8 bushels of clean seed wheat. Tip the wheat on a clean board floor and apply the mixture, thoroughly turning till wheat is all saturated. Let it stand for a few minutes and bag. It will be ready for use about two days afterwards. It is advisable to pickle a few days ahead. If sowing early on a dry seed-bed, and there is no danger of the seed germinating at once, pickling is not necessary.

*NOTE.—Mr. Stocks has not drawn attention to the absolute necessity of removing unbroken bunt balls before pickling—a matter which was emphasised throughout the discussion on the subject at the Conference.—ED.

Seeding.

A 16-tine stump-jump cultivator (latest improved), on the same principle as a skim plough, works the fallow thoroughly to a depth of 2½ to 3 inches, ready for the drill.

I advise seeding during the months of April and May, finishing early in June. I recommend 60 lb. of graded seed per acre for new fallowed land, and 50 lb. for stubble land.

Superphosphate.

Old land requires 50 to 60 lb. of manure per acre; new fallow 30 lb. Of course, much depends on the nature of the soil. I am referring to a light sandy loam soil. Heavy soils require less manure.

Harvesting.

I favour a system of binding and threshing until the crop is too ripe for the binder, when a harvester should be used to complete the operation by stripping. The straw is a very valuable asset on a farm, and stacks should be carefully thatched to protect them from bad weather.

Hay.

It is advisable to grow a portion of the crop for hay. Only hay varieties should be grown for that purpose. I have been very successful on Cunningham Plains with Yandilla King, cutting 3 tons per acre on fallowed land last season, on undulating country; also harvesting a good yield. The grain is a strong wheat, and is in demand for milling purposes.

Barley.

I have also grown malting barley successfully, the grain having a good colour, and although lacking in plumpness it secured top market price.

Smut in Grass.

I have had considerable experience with smut in grass, especially in South Australia, and find that it is only produced in flat or crab-holey country, subject to inundation for a period. It has nothing to do with bunt in wheat.

Drake.

Drake is a weed, and is not connected with wheat in any shape or form. The impression that wheat will, under certain conditions, turn to drake, is an utterly erroneous one.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th (imp.).	Wollongbar Farm	†
,, ...	March Pansy ...	Earl March ...	Australian Pansy.	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II. ...	Thessalian (imp.).	Egyptian Princess (imp.).	Wagga Exp. Farm	*
,, ...	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm ...	*
,, ...	Golden Lord ...	Golden King (imp.).	Colleen (imp.)	Wagga Exp. Farm	*
Guernsey ...	Gentle Prince ...	Rose Prince (imp.).	Gentle ..	Rous Mill... ...	5 Sept., '10.
,, ...	The King's Mirror.	Calm Prince ...	Vivid (imp.)...	Cumbalum ...	10 Oct., '10.
,, ...	Star Prince ...	Calm Prince ...	Vivid (imp.)...	Dunoon	3 Oct., '10.
,, ...	Prince Souvia ...	Vivid's Prince...	Souvenir (imp.)	South Woodburn..	21 Dec., '10.
,, ...	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Wollongbar Farm	*
,, ...	Claudius ...	Golden Star II..	Claudia's Pride (imp.).	H.A. College, Richmond	*
,, ...	King of the Roses	Hayes' King ...	Rose 8th (imp.)	Berry Farm ...	*
,, ...	Royal Preel ...	Otchen Royal ...	Hayes' Lily du Preel (imp.).	Wollongbar Farm	*
Red Poll ...	The Judge ...	Barrister (imp.)	Lovely 8th (imp.).	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General (imp.)...	Judy 9th (imp.)	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ...	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ...	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Dan of the Roses	Daniel of Auchenbrain (imp.).	Ripple Rose...	H.A. College, Richmond	*
Kerry... ...	Kildare II ...	Kildare (imp.)...	Belvedere Bratha 3rd (imp.).	,, ,,	*
,, ...	Bratha's Boy ...	Aicme Chin (imp.).	Bratha 4th ...	,, ,,	*
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Holstein ...	Hollander ...	Bosch III. (imp.)	Margaretha (imp.).	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 2nd September, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

AYRSHIRE.—Lord Roseberry: sire, Auchenbrain Spicy Jock (imp.); dam, Primrose II; calved 15th December, 1908; colour, brown and white. Price, **£20.**

Primrose II is by General from Miss Prim. Miss Prim is by Mischiefmaker (imp.), from Primrose of Barcheskie (imp.). Primrose II is a beautiful cow, showing great milking and show type, with large teats and udder. Miss Prim is pronounced by our best judges to be one of the best cows in the State. A recent visitor from New Zealand declared they had no cows to compare with Rose Berry, Primrose II, and Miss Prim.

GUERNSEY.—Harmony: sire, Calm Prince; dam, Hayes' Muzette 7th (imp.); calved 13th October, 1909; colour, lemon and white. Price, **£40.**

Calm Prince, by Rose Prince (imp.), from Gentle. Gentle, by Masher (imp.), from Calm (imp.).

JERSEY.—*Blue Spec: sire, Berry Melbourne; dam, Lally Optician; calved 29th July, 1909; colour, whole. Price, **£20.**

Berry Melbourne, by Melbourne (imp.), from Rum Omelette (imp.).

Lally Optician, by Sir Jack, from Bellona; Bellona, by Optician (imp.), from Pattibelle.

MILKING SHORTHORN.—*Cornishman: sire, Dora's Boy; dam, Forest Pansy; calved 24th December, 1908. Price, **£20.**

HAWKESBURY AGRICULTURAL COLLEGE.

AYRSHIRES.—Dado: sire, Daniel of Auchenbrain (imp.); dam, Dot, by Hover of Southwick (imp.), from Flirt, by Heir of Randwick (imp.), from Lady of Randwick; calved 23rd March, 1904; colour, white and brown. Price, **£20.**

Emerald's Mischief: sire, Prince Emerald (imp.): dam, Miss Prim, by Mischiefmaker of Barcheskie (imp.), from Primrose of Barcheskie (imp.), by Royal Stuart of Glenbuck, from Lindsay 7th of Barcheskie; calved 4th August, 1903; colour, white and red. Price, **£30.**

WOLLONGBAR EXPERIMENT FARM.

HOLSTEIN.—De Wet: No 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909. Price, **£10.**

The prices indicated are at the places named, or on rail.

H. C. L. ANDERSON,
Under Secretary.

* Applications for his bull will be held till 21st September. If more than one application be received, his disposal will be decided by ballot.

Orchard Notes

W. J. ALLEN.

SEPTEMBER.

Pruning.

IT is to be hoped that the man who has been engaged upon this important work, whether for himself or for others, will have noted where each different sort of fruit tree carries its fruiting wood, that is what aged wood: also where the fruiting spurs or buds make their appearance on such wood; and whether or not trees pruned heavily each year produce as large a crop of marketable fruit as those not so severely pruned. No orchardist should be without his experimental plot of trees where pruning has been done in several different ways. Some trees may be cut to short spurs, whilst others may have good long laterals left, with leaders and laterals thinned out but not cut back severely excepting where the limbs are too thick, in which case a limb may be removed altogether in place of being spurred back

These remarks refer more particularly to apples and pears than to plums, apricots, and peaches, which latter usually put forth plenty of good fruiting wood. It will, however, be seen that some plums will lose their fruiting wood towards the bottom of the limbs and centre of the tree if they are not cut rather severely, whilst others will not be so affected. Again, some varieties of peaches will be found with fruiting buds towards the centre and extreme ends of new growth, whilst other varieties will have good fruiting wood throughout the whole length of the lateral. In the latter case the new growth may be thinned somewhat and laterals and leaders shortened back as required. In the former case care will have to be exercised to see that there are sufficient fruiting buds left on each lateral, otherwise the grower may find when the tree breaks into bloom that he has not left sufficient fruiting buds. This would naturally result in a light crop.

In both apple and pear trees the pruning for the first three winters should be with a view to establishing a well-balanced, roomy, rather open tree. After that a much lighter system must be adopted, which might be termed thinning rather than pruning; as it has been found that by continuing to prune heavily many varieties of apple and pear trees, wood rather than fruit will be produced. In order to encourage good fruiting buds and spurs it is advisable, in most cases, to simply thin the tree, removing altogether any undesirable limbs, but leaving long laterals—by preference those which are shooting forth in a horizontal rather than a perpendicular direction from the leaders.

In most cases trees so treated will not require summer pruning. The winter pruning can be more easily carried out, and the tree will, within a year or two, begin carrying crops of fruit. When once they have been thrown into fruiting, undesirable limbs may be removed, and laterals, which may be too slender or long, shortened back; but it must not be forgotten that such trees properly pruned in the winter should require little (if any) summer pruning.

We should not allow weak trees to carry too much fruit, but on the other hand we should encourage strong growing trees to start fruiting young and grow fruit rather than excessive wood. By treating them as described above, we will in most cases accomplish this end.

Pruning the Orange and Lemon.

Citrus trees should be thinned out, and, where necessary, have their limbs shortened back as soon as possible this month.

Planting Citrus Trees.

These should be put in with as little delay as possible now. See that the roots are never allowed to become exposed to either sun or wind, and that they (the roots) are well spread and covered with good, moist soil; but no fertilisers should come in contact with either roots or trunks of trees. After planting, remove any excessive growth and shorten back if too high. See that the ground around them is loosened frequently with the fork-hoe.

Where dickey rice is bad the tree should be sprayed with arsenate of lead, same strength as for codlin moth. The application should be made with as little delay as possible.

The Green Crop.

If the green crop has not been turned under, it should be done as early as possible, in order that the crop may become well rotted while there is still considerable moisture in the soil. If such crops are allowed to remain in until the land becomes dry, it will be found almost impossible to plough the soil, to say nothing of turning them under; and the chances are that, instead of doing good, the opposite effect will result, as the moisture, in place of being conserved, will have been taken up by the crop. The soil will thus have become hardened, and when ploughing is attempted the ground will break apart in lumps, and it will be found impossible to turn the crop under, which will thus dry up instead of rotting as it should.

Spraying.

If the spring proves to be a wet one, it is advisable to spray trees which have in previous years showed signs of fungous diseases, such as peach curl in the peach trees, black spot or scab of the apple, and shot-hole fungus of the apricot. Lime, sulphur, and Bordeaux mixture will be found the best sprays at this time of the year for all fungous diseases; and all deciduous fruit trees would be benefited by an application.

Should the San José scale put in an appearance after the leaves have started on the trees, the resin, soda, and fish oil wash will be found the best to use at this season of the year; yet it may damage the fruit a little unless applied very weak. Never spray any trees or vines when they are in bloom, as the chances are that the crops will be destroyed. They may be sprayed a week before coming into bloom, and a week after the fruit is set. In all cases see that the orchard is in thorough condition, as the future crop depends so much on the condition in which the trees and soil are kept during the summer months.

It is well to make early arrangements for fighting the codlin moth. It has been proved that four applications of arsenate of lead will control this serious pest. The first spraying should be given just as most of the petals have fallen. This is the most important spraying of the four. The quantity used is 4 lb. to 100 gallons of water. The second spraying should follow a fortnight to three weeks after the first, using 3 lb. of arsenate of lead to 100

gallons of water. Subsequent sprayings may be given at intervals of every three or four weeks if the moth is bad, using 3 lb. to 100 gallons of water. In spraying trees with this, or any other spray, see that a good pressure is kept up so that the pump will throw a good fine mist, and be particular to cover the inside and outside of the tree as well as the whole of the fruit.

It is rather late for planting deciduous trees, even during the earlier part, yet, if they are given special care, such trees and vines may be planted. Careless handling is usually responsible for loss. All soil should be loosened either with a fork-hoe or chipping-hoe, around trees and vines, and all couch grass, sorrel, or other weeds removed and burnt. This work should be carried out in the early spring, while the soil is moist and easy to work.

Specimens of Fruit.

I have to acknowledge receipt of some very fine specimens of Washington Navels, grown by Mr. James Simmons, of Wangat, near Dungog. If fruit of the quality submitted can be grown in quantities, it would pay to extend the area under cultivation in that district.

Peach Tree, 4 years old, at Wentworth.

Yates' Apple.

Some very fine specimens of this variety, grown on the orchards of Messrs. Robertson and Brown, Mount Keira, South Coast, were forwarded for identification.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Young P. and A. Association	G. S. Whiteman	Sept. 6, 7, 8
Ariah Park P., A., H., and I. Association	A. T. White	,, 7
Germanton P., A., and H. Society	J. S. Stewart	,, 7, 8
Cowra P., A., and H. Association	J. T. Martin	,, 13, 14
Albury and Border P., A., and H. Society	W. I. Johnson	,, 13, 14, 15
Ganmain A. and P. Association	J. H. Ashwood	,, 14
Moama A. and P. Association	J. C. Smith	,, 14
Northern A. Association (Singleton)	H. A Bennett	,, 14, 15, 16
Cootamundra A., P., H., and I. Association	T. Williams	,, 15, 16
Canowindra P., A., and H. Society	G. Newman	,, 20, 21
Temora P., A., H., and I. Association	John Clark	,, 20, 21, 22
Millthorpe A. and P. Association	R. H. French	,, 27, 28
Adelong P. and A. Association	A. W. Molineaux	Oct. 4, 5
Crookwell A., P., and H. Society (Spring Show)	M. P. Levy	,, 7
Wallsend and Plattsburg A. Society	R. Maddison	,, 21, 22
Mullumbimby A. Society	N. Neilsen	Nov. 9, 10
Tweed River A. Society (Murwillumbah)	A.E. Budd	,, 16, 17
Newcastle A. H. and I. Association (Spring Show)	C. W. Donnelly	,, 18, 19
Lismore A. and I. Society (State National Show)	T. M. Hewitt	,, 22–25

1911.

Society.	Secretary.	Date.
Albion Park A. and H. Association	H. G. Fraser	Jan. 18, 19
Kiama A. Association	R. Somerville	,, 25, 26
Alstonville A Society	W. W. Monaghan	Feb. 8, 9
Berry A. Association	C. W. Osborne	,, 8, 9
Coramba District P., A., and H. Society	H. E. Hindmarsh	,, 15, 16
Shoalhaven A. and H. Association (Nowra)	H. Rauch	,, 15, 16
Gunning P., A., and I. Society	J. L. Sands	,, 22, 23
Kangaroo Valley A. and H. Association	J. Moffit	,, 23, 24
Southern New England P. and A. Association (Uralla)	W. C. McCrossin	,, 28, Mar. 1, 2
Inverell P. and A. Association	J. McIlveen	,, 28, Mar. 1, 2, 3
Robertson A. and H. Society	R. J. Ferguson	Mar. 2, 3
Gundagai P. and A. Society	A. Elworthy	,, 7, 8
Bangalow A. and I. Society	W. H. Reading	,, 7, 8, 9
Tenterfield P , A., and M. Society	F. W. Hoskin	,, 7–11
Bombala Exhibition Society	W. G. Tweedie	,, 8, 9
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	,, 8, 9
Macleay A. H. and I. Association (Kempsey)	E. Weeks	,, 8, 9, 10
Crookwell A., P., and H. Society (Annual Show)	M. P. Levy	,, 9, 10
Berrima District A., H., and I. Society (Moss Vale)	I. Cullen	,, 9, 10, 11
Central New England P. and A. Association (Glen Innes)	G. A. Priest	,, 14, 15, 16
Cobargo A. P. and H. Society	T. Kennelly	,, 15, 16
Bellinger River A. Association (Bellingen)	S. S. Hindmarsh	,, 15, 16, 17
Mudgee A. Society	H. Lamerton	,, 15, 16, 17
Port Macquarie and Hastings District A. and H. Society	W. R. Stacy	,, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	,, 16, 17, 18
Luddenham A. and H. Society	W. Booth	,, 21, 22
Armidale and New England P., A., and H. Association	A. McArthur	,, 21–24
Camden A., H., and I. Society	C. A. Thompson	,, 22, 23, 24
Taralga A. P. and H. Association	G. C. Goodhew	,, 23, 24
Newcastle A. H. and I. Association (Annual Show)	C. W. Donnelly	,, 23, 24, 25
Blayney A. and P. Association	E. J. Dann	,, 28, 29

Society	Secretary.	Date.
Walcha P. and A. Association	J. New-Campbell	Mar. 28, 29
Yass P. and A. Association	W. Thomson ...	,, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 5, 6
Dorrigo A. Society	F. T. Stennett ..	,, 5, 6
Dungog A. and H. Association	C. E. Grant ...	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 5, 6, 7
Royal A. Society of N.S.W. (Sydney)...	H. M. Somer ...	,, 11–19
Queanbeyan P., A., H., and I. Association	E. C. Hinchsman	,, 12, 13
Bathurst A., H., and P. Association	A. H. Newsham...	,, 26, 27, 28
Orange A. and P. Association	W. Tanner ..	May, 3, 4, 5.

Contributions to the Farrer Memorial Fund.

Name.	Address.	£	s.	d.
Amount received to 23rd July, 1910		745	10	10
Royal Agricultural Society ...	Sydney	100	0	0
A. A. Dangar	Singleton	5	0	0
T. Bragg	Narromine	2	2	0
A. Bushell	Temora	1	0	0
G. H. Varley	Sydney	2	2	0
F. and S. Association	Nea Siding	1	0	0
Do do	Bonshaw	1	1	0
Do do	Yeoval	1	1	0
Do do	Tomingley	2	1	6
Do do	Maule's Creek	1	0	0
Do do	Mandamah	1	0	0
Do do	Wallendbeen	1	1	6
Do do	Delegate	1	1	0
Do do	Narrandera	0	10	0
P. and A. Society	Urana	2	2	0
P. and A. Association	Coonabarabran	2	2	0
W. McIlwraithe	Rockhampton, Queensland	1	0	0
T. Manning	Richlands, Springdale	1	0	0
— Crisp	The Bungalow, Springdale	1	0	0
Jas. Wilson	Gladstone, Queensland	1	1	0
R. O. Beale	Tomerong, via Nowra	0	10	6
A. V. Rhodes	Spring Hill	0	10	6
Jas. Angus	Rooty Hill	5	0	0
R. G. Witts	Parkes	0	10	6
W. Le Gay Brereton	Experiment Farm, Glen Innes	0	10	6
O. Major	Lautoka, Fiji	0	10	0
Shand Bros.	Berrigan	1	0	0
William Pyle	do	1	0	0
E. J. Gorman	do	2	0	0
G. Woodburn	Charters Towers, Queensland	1	1	0
A. H. Purkis	Tenterfield	0	10	6
H. Fane de Salis	Eumeralla, Cooma	5	0	0
A. and P. Society	Cudal	1	1	0
Do do	Tumbarumba	1	1	0
A. and H. Society	Port Macquarie	1	1	0
P. and A. Association	Cooma	1	1	0
A. and H. Association	Nowra	1	1	0
F. and S. Association	Duri	0	10	0
Do do	Springdale	2	2	0
Agricultural Association	Bellingen	1	1	0
C. B. Henning	Lennoxton, Paterson	1	1	6
G. L. Lewin	Clinton, Inverell	0	10	0
Total amount received to 20th August, 1910		£902	8	10

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LONGFELLOW

SIBLEY.

EARLY YELLOW DENT

SOLOMON'S PRIDE.

EARLY LEAMING.

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Agricultural Gazette of New South Wales.

Farmers' Experiments.

SUMMER CROPS—SEASON 1909–10.

GEORGE VALDER, Chief Inspector.

FOR the purpose of carrying out experiments with maize for grain, and maize, sorghum, millets, and cowpeas for fodder, some twenty plots were selected in the Coastal Districts, and sixteen in the Inland Districts.

Experiments were conducted upon the following farms:—

North Coast.—

Casino	C. Crowther.
Maclean	McDonald Bros., Woodford Park.
Myrtle Creek	F. Scott.
Wollongbar	Experiment Farm.
Grafton	Experiment Farm.
Murwillumbah	A. J. Brown.
Kyogle	W. Saville.
Macksville	R. Turnbull.
West Maitland	A. and H. Association.

South Coast.—

Unanderra	L. Carr.
Dapto	G. Lindsay.
Albion Park	A. Wilson.
Berry	Experiment Farm.
Milton	T. Gould, junior.
Pambula...	J. H. Martin.
Moruya	J. McKeon.
Bemboka	G. Lucas.
Kangaroo Valley ...	J. Chittick.
Moss Vale	J. Dobb.
Nelligen	E. McCauley.

Western District.—

Maryvale	Major Barton, M.L.A.
Parkes	W. Iram Nash.
Mudgee	H. Coughey.
Gilgandra	J. W. Lithgow.
Narromine	E. O'Neill.
Orange	A. and P. Association.
Blayney	R. A. Marsden.

Southern District.—

Rosewood	J. Eisenhauer.
Deniliquin	M. J. Carew.
Tumut	Dr. W. H. Mason.
Yanco	Experiment Farm.

A

Northern District.—

Gunnedah	R. McAdam.
Narrabri	J. B. Brake.
Wee Waa	C. Abbott.
Inverell	C. C. Loxton
Guyra	G. Moore

MAIZE.

Varieties under Trial.

Maize experiments, both variety and manurial trials, were made with four varieties, viz., Yellow Dent, Hickory King, Iowa Silvermine, and Pride of the North, the two former being late varieties, and the two latter early ones. Yellow Dent and Hickory King were selected because they had given the best results last season both for fodder and grain; Iowa Silvermine for its qualities as a quick-growing fodder and grain variety; and Pride of the North as an early maturing grain variety.

Varieties Imported from the United States and Victoria.

Besides the above, the Department imported seed of four varieties from the United States, viz., Funk's Yellow Dent, Boone County Special, Cocke's Prolific, and Marlbro' Prolific; and also four varieties from Victoria, viz., Longfellow, Early Yellow Dent, Sibley, and Early Leaming. These, although put under trial on a small scale, were not compared with the New South Wales varieties, as it was considered unfair to make a comparison until the varieties had become acclimatised. All of these will, however, be available for trial on a large scale this season.

Maize for Grain.

These trials were conducted on the North Coast only. The yields were:—

	Yellow Dent.		Hickory King.		Iowa Silvermine.		Pride of the North.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Casino	47	20	22	16	37	4	30	2
Maclean	62	38	58	7	52	28	37	43
Myrtle Creek	65	18	40	44	54	48	28	16
Wollongbar...	32	0	37	0	9	0	9	0
Grafton	48	18	33	42	21	38	19	12
Murwillumbah	99	24	69	12	62	20	50	36
Kyogle	65	28	50	27	40	34	45	2
Macksville	40	2	32	16	24	38	16	4
West Maitland	88	0	49	0	......		62	0

Average Yields:—

	bus.	lb.
Yellow Dent	60	54
Hickory King	43	37
Silvermine	37	47
Pride of the North	33	6

Maize for Fodder.

COASTAL DISTRICTS.

	Yellow Dent.			Hickory King.			Iowa Silvermine.			Pride of the North.		
	t.	c.	qrs.	t.	c.	qrs.	t.	c.	qrs.	t.	c.	qrs.
Dapto ...	4	8	2	2	0	0	2	0	0	...		
Berry ...	16	0	0	9	14	1	10	17	0	11	17	0
Albion Park ...	...			15	14	2	12	1	0	12	3	0
Moss Vale ...	6	1	2	5	0	2	7	7	2	1	16	2
Milton ...	13	11	1	9	0	0	.....			.....		
Pambula ...	27	2	3	11	10	2	23	0	0	.....		
Maclean ...	16	3	1	11	3	3	......			.....		
Grafton ...	19	5	0	14	0	0	8	5	0	9	0	2
Moruya ...	6	12	3	3	2	0	......			.....		

Average Yields:—

	Tons	cwt.	qrs.
Yellow Dent ...	13	13	0
Iowa Silvermine ...	10	11	0
Hickory King ...	9	0	2
Pride of the North ...	8	14	1

WESTERN DISTRICT.

	Yellow Dent.			Hickory King.			Iowa Silvermine.			Pride of the North.		
	t.	c.	qrs.	t.	c.	qrs.	t.	c.	qrs.	t.	c.	qrs.
Parkes ...	18	0	0	14	0	0	9	0	0	9	0	0
Mudgee ...	25	0	0	20	0	0	12	0	0	12	0	0
Gilgandra ...	20	0	0	18	0	0	10	0	0	10	0	0
Narromine ...	16	0	0	13	0	0	6	0	0	5	0	0
Orange ...	15	0	0	12	0	0	6	0	0	5	0	0
Maryvale ...	19	0	0	16	0	0	10	0	0	9	0	0

Average Yields:—

	Tons	cwt.	qrs.
Yellow Dent ...	18	16	2
Hickory King ...	15	10	0
Iowa Silvermine ...	8	16	2
Pride of the North ...	8	6	2

In consequence of several of the plots being damaged by heavy rains, attacks of grasshoppers, &c., the returns from the southern and northern plots are incomplete, and are therefore omitted, as partial returns might be misleading.

Notes on the Varieties.

Yellow Dent.—It will be seen that this variety occupied first place in all three of the experiments. It has proved to be the best all-round variety we have yet obtained, and it will be used as our standard in testing the new American and Victorian varieties. The cobs are large, grain long and narrow, with small core, and the forage is of excellent quality.

Hickory King.—The results obtained from this variety were very disappointing, the average yield of grain and fodder being much below that of Yellow Dent.

Iowa Silvermine.—This again proved to be the best early variety, both for grain and fodder. Although no estimate was made of the yield of grain of this variety in the western plots, the crops being cut for fodder, it promised to be one of the best for grain production in these districts, and can be recommended for trial.

Pride of the North.—This variety is not generally considered to be a good one for production of fodder, but was looked upon as being one of the best of the early-maturing grain varieties. The results obtained, however, seem to show that it is very inferior to Iowa Silvermine for this purpose.

Maize Manurial Trials.

Two manures were used, which were made up as follows:—

M. 1—3 cwt. dried blood.
2 ,, bonedust.
4 ,, superphosphate.
1 ,, sulphate of potash.
10 ,,

M. 4—1 cwt. sulphate of ammonia.
$7\frac{1}{2}$,, superphosphate.
$1\frac{1}{2}$,, sulphate of potash.
10 ,,

One plot of maize was dressed with each of these manures at the rate of $1\frac{1}{2}$ cwt. per acre, and a check plot was sown without any manure. This experiment was conducted at twenty different centres on the North and South Coast, stretching from Murwillumbah on the Tweed River to Pambula in the far south. Half of this number were cut for fodder and half for grain. The average returns of all these were as follow:—

	Manure.	Average Yield.	No. of Trials.
		t. c. qrs.	
Fodder	No manure ...	12 5 2	10
	M. 1 ,, ...	13 2 0	10
	M 4 ,, ...	12 0 2	10
		bus. lb.	
Grain	No manure ...	54 35	10
	M. 1 ,, ..	57 31	10
	M. 4 ,, ...	55 35	10

Manure applied at the rate of $1\frac{1}{2}$ cwt. per acre; cost, 10s.

In the fodder trials, No. 1 manure gave the best results in five trials, No. 4 manure in four trials, whilst in two trials the results from the no manure plot were the highest.

In the grain trials, No. 1 manure gave the best results in five trials, No. 4 manure in three trials, whilst the yield from the no manure plot was highest on two occasions.

M. 1, the manure recommended by the Department's Chemist, Mr. Guthrie, again proved better suited for most of our maize soils than M. 4; the slow-acting blood and bonedust again proving superior to the quick-acting sulphate of ammonia and superphosphate.

The average gain by manuring with M. 1 was 16½ cwt. of green fodder and 3 bushels of grain per acre, at a cost of about 10s. for manure. This does not seem to be a very satisfactory result, but it will be noticed that on some of our rich soils, such as those of Pambula, Tumut, and Grafton, the manures had no good effect; whereas on the poorer soils, such as at Myrtle Creek and Moss Vale, the increased yield from manuring was very great, running up to 10 bushels of grain and 2 to 3 tons of green fodder per acre. This is only the result of one year's trial, and, therefore, it cannot be taken as conclusive, but it is further evidence of the necessity for manuring fodder crops on our poorer soils, and on soils that have been cropped for any length of time. The inspectors reported that, on some of the poorer soils on the coast, farmers found it advisable to give heavier dressings of manure than that applied to the plots, from 2 to 3 cwt. per acre giving the best results.

American varieties of Maize.

With regard to the four varieties of maize, seed of which had been obtained from the Department of Agriculture, Washington, United States of America, the evidence of one season's trials points to Funk's Yellow Dent and Boone County Special as being good grain-producing varieties, and Cocke's Prolific and Marlbro' Prolific as being specially suitable for yields of fodder and silage. A trial of the four varieties for forage purposes, at the Berry Stud Farm, resulted as follows:—

	Tons	cwt.	qrs.
Marlbro' Prolific	27	11	3
Cocke's Prolific	23	2	3
Funk's Yellow Dent	15	0	0
Boone County Special	13	0	2

Although no comparison was made with local varieties, there can be no doubt but that the first two are excellent forage varieties, and the trials to be conducted with them in comparison with the best local varieties this year will be looked forward to with considerable interest.

Victorian varieties of Maize.

These four varieties were obtained with the object of endeavouring to procure better quick-maturing varieties for grain production than those already grown here. A trial made at Tumut resulted as follows:—

Early Leaming	48 bushels per acre.
Sibley	43 " "
Early Yellow Dent...	35 " "
Longfellow	35 " "

As this Early Leaming is apparently the same variety as that grown here under that name, it looks as if none of the Victorian maizes are likely to equal those already grown here. It is not fair, however, to judge from one trial, and probably different results will be obtained in the trials to be made this season. Sibley and Early Yellow Dent both seemed to be varieties worthy of extensive trials; the latter, being very early, should be especially suitable for the inland districts.

Maize v. Maize and Cowpeas.

Experiments were again made in order to find out the relative yields of maize sown alone against maize and cowpeas mixed. Six trials were made on the South Coast, with the following result:—

	Average Yield per acre.		
	Tons	cwt.	qrs.
Maize and Cowpeas	13	0	0
Maize alone	11	0	0

This is further proof that the mixture will give a greater yield per acre than maize alone; and besides the greater yield it must be remembered that the combination is a more valuable food for all classes of stock.

Trials of the mixture were also made in the inland districts, but the results varied considerably. In some cases the cowpeas made a vigorous growth, climbing up the maize stalks to a height of 6 or 7 feet, and producing heavy crops of valuable fodder.

Sorghums.

As none of the recently introduced sorghums had been found equal to the varieties already grown here, it was decided to confine the experiments to a trial of the three old and well-known varieties, viz:—Planter's Friend, *Sorghum saccharatum*, and Early Amber Cane. These plots were sown in twenty one different places, twelve being on the coast and nine inland. The average yields from these twenty-one plots were as follow:—

	Tons	cwt.	qrs.	
Planter's Friend	16	7	2	per acre
Early Amber Cane	14	4	2	,,
Sorghum saccharatum ...	13	11	3	,,

Planter's Friend.—Is undoubtedly the best all round variety of sorghum that we have. Both inland and on the coast it gave by far the heaviest yields; it has also the advantage that it stands the cold weather well, and therefore is of great assistance in carrying stock through the winter months.

Early Amber Cane.—This variety is a much quicker grower than Planter's Friend, and it is therefore a good variety to sow for early feed. The cane is finer than that of Planter's Friend, and it is of excellent quality.

Sorghum saccharatum.—Although generally considered to be a good variety, it proved to be not nearly equal in any way to the other two sorghums under trial.

An examination of the crops of sorghum grown on the coast showed that in nearly every case the seed used could not have been pure. It is important that farmers should endeavour to raise better quality seed. This can only be done by obtaining pure samples and growing them at some distance from other crops of sorghum, so that there will be little risk of their becoming inoculated. The Department is taking steps to secure better samples of sorghums, and will have seed specially sown during the coming season.

Sorghum and Cowpeas Mixed.

Several trials of sorghum and sorghum and cowpeas were made, but the results during the past season were unsatisfactory, the cowpeas not doing nearly so well when sown with sorghum as with maize.

Cowpeas.

Trials were made with five varieties, Black, White, Clay-coloured, New Era, and Whip-poor-will. Black and Clay-coloured again proved to be the heaviest croppers, and when sown with maize or sorghum made a strong growth, and climbed to a considerable height up the maize and sorghum stalks.

ENSILAGE.

Between twenty and thirty ensilage stacks were erected by the several inspectors during the season, the forage from the plots being utilised for the purpose and demonstrations being given to farmers regarding silage stack-building. Letters have been received from the various farmers stating that the silage was a great success, and indicating that this work would have very great effect in increasing the amount of silage made in the various districts.

Notes on Western District Forage Plots.

M. H. REYNOLDS, Inspector of Agriculture.

In the spring of 1909, arrangements were made with seven farmers, situated in different parts of the Western district, to conduct small forage plots, under the supervision of the Department of Agriculture. The object of these plots was to demonstrate the suitability or otherwise of certain summer crops, and simple methods of conserving same in the form of silage. Five of the plots were on fallowed land, and one on pasture land freshly broken up but cultivated some years ago.

At Orange the plot was situated on high ground, and although frosts affected the growth, the plants made a good recovery. Maize and sorghum, 4 to 8 feet high, was cut and stacked for silage during the latter part of March.

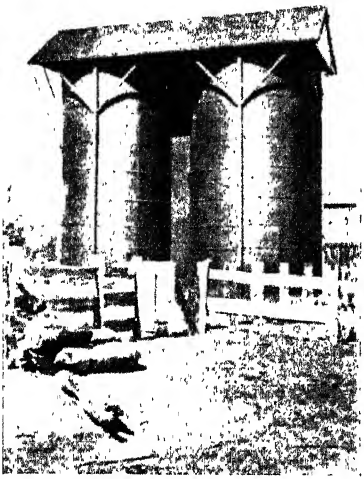
The area of land set apart ranged from 6 to 10 acres (except at Orange). The land was ploughed in August and September to a depth of 5 to 7 inches, the depth varying according to character of soil. The land was harrowed later. Seeding operations were conducted in October in the following order:—Narromine, 1st and 2nd November; Maryvale, 4th and 5th; Parkes, 15th and 16th; Gilgandra, 18th and 19th; Mudgee, 21st; Orange, 2nd November.

At each place a wheat drill (the makes differing) was used for sowing the seed; two outside tubes and the centre tube alone operating, so that the distance between drills was in each case approximately 3 feet. Seed was sown at the rate of: Maize, 16 to 22 lb.; sorghum, 6 to 12 lb.; cowpeas, 13 to 20 lb. per acre; and mixtures of maize and cowpeas or sorghum and cowpeas were also sown. The lightest sowing with maize, sorghum, and cowpeas above stated is satisfactorily fed by many makes of wheat drill, and these quantities proved quite sufficient. The mixture, maize and cowpeas, was fed on the coarse or oat side, and the sorghums on the fine or wheat side of the machine. Mixtures of sorghum and cowpeas may be sown on the coarse side, but a more even distribution of the mixed seeds occurs by fixing the shutter upright and allowing the cowpeas to feed on the coarse side and the sorghum on the fine side concurrently.

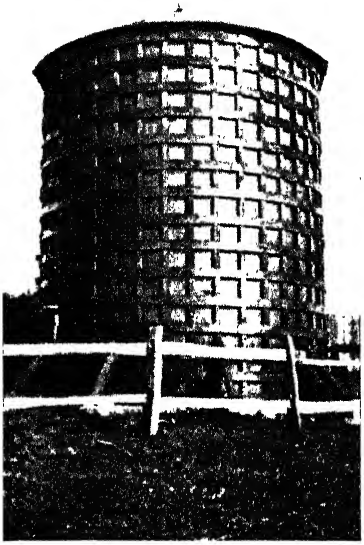
The following sketch will give a general idea of the plan of the experiment:—

Maize variety trial.
Maize manurial trial.
Maize and cowpeas mixed.
Sorghum variety trial.
Sorghum manurial trial.
Sorghum and cowpeas mixed.
Cowpeas variety trial.

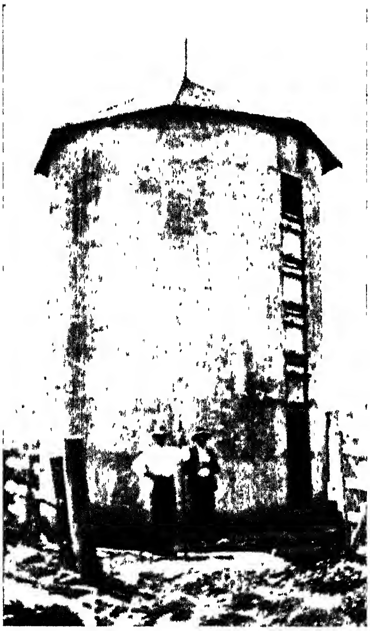
Mixed fertilisers M 1 and M 4 were sown with the seed at the rate of $1\frac{1}{2}$ cwt. to the acre. Portions of the land were not manured. Subsequent cultivation consisted of cross-harrowing shortly after each fall of rain until the maize was 1 foot high, and in most cases a horse-hoe was worked between the rows later, the object being to retain by cultivation as much moisture as possible, and to keep weed-growth in check. The plots were cut and stacked for silage during March and April.



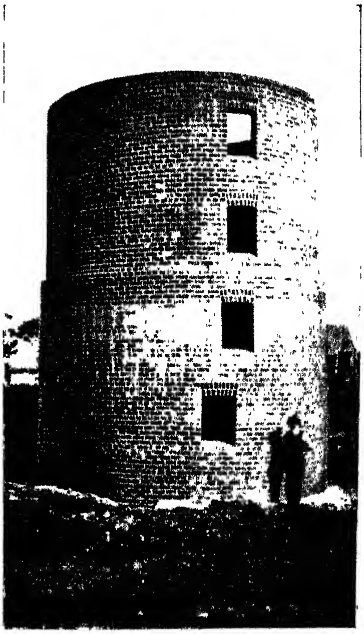
Twin Tub Silos, Kameruka.



Wood and Iron Silo. Mr. Geo. Grey, Kiama.



Ferro-cement Silo. Mr. Geo. Lindsay, Dapto.



Brick Silo. Mr. R. Read, Central Tilba.

Types of Silos on the South Coast.

Silage on the South Coast.

R. N. MAKIN, Inspector of Agriculture.

OF late years the South Coast has experienced some very dry seasons. Although in some parts the rainfall has been about the average, it has not come at the time when it would have been most beneficial. However, it is pleasing to note that a number of the leading dairymen are making provision for dry times by conserving fodder in the form of silage. This season is a record on the coast for the amount of silage made, and in most cases, the work has given splendid results. Central Tilba A.B.C. Cheese-factory reports in its half-yearly balance-sheet:—

> The satisfactory increase in milk supplies is wholly attributable to the provision of silos, without which there would have been a serious shortage in supplies, judging by the reduced supplies from the dairies which are not supplied with silos.

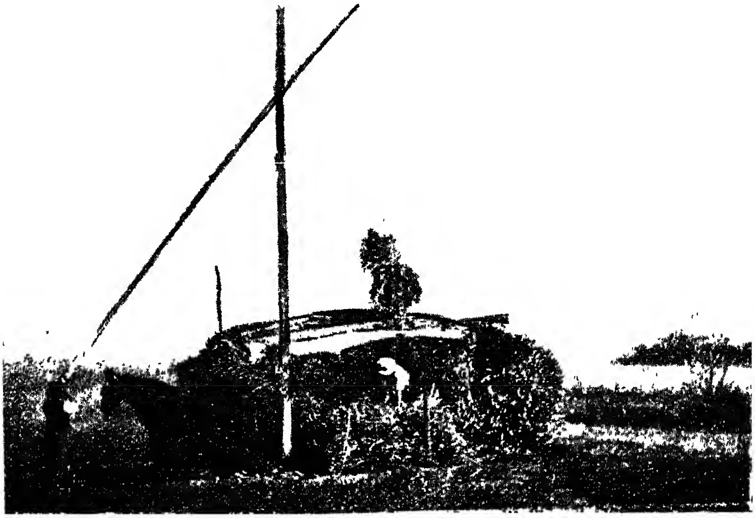
The silo has undoubtedly come to stay on the South Coast, and it will not be long before every up-to-date farm will have one or two. Dapto and Tilba districts lead the way. In both these districts silos have been erected in all directions, and many more are to go up for the coming season.

In many cases on rented farms, stack silage has given very good results; but the drawback to this system is the loss incurred through the air getting in. There are different methods of building stack silos; the one adopted by the Department during the past season has given very satisfactory results.

In the first place, the idea of bringing the greenstuff in on a slide works well. When the slide goes to load up, three ropes are taken. Before loading, one rope is laid across the bottom of the slide and the stuff placed upon it When the slide is about one-third laden, the second rope is placed across; then when two-thirds full, the third rope is laid across and the slide topped up. When the load draws up under the whip-stick, No. 3 rope is tied over the bundle under which it rests, and is hauled up, and so on with Nos. 2 and 1. By this means the slide is quickly unloaded in three lifts.

The whip-stick is a very simple and convenient method of lifting stuff from the slide. It consists of a stout pole placed about 2 feet away from the stack, with a good straight pole from 20 to 25 feet long attached to it by a chain, swung so that the end to which the bundle is to be attached is just off the balance, hanging down when not in use. On the other end of the pole a long rope is attached, with which to hoist the bundle up. The photo. shows a bundle being hoisted, and when once it is in this position it is easily placed on almost any part of the stack.

In previous articles we have advocated the use of a block and tackle, worked with a horse, for hoisting silage on the stack; but by the use of this



Whip-stick used by Mr. G. Lindsay, Dapto, showing method of hoisting. The second rope is being tied on the slide.

whip the horse can be done away with. This is a very great advantage on many small farms, as all the horse-power available is required for carting in the forage. At Mr. Wallis' farm, Manchester Square, Moss Vale, I saw a whip being used by a boy of 15 or 16 years of age for hoisting silage up to a height of 28 feet. The work was done satisfactorily, and without any apparent undue exertion on the part of the boy.

The method of crossing the stuff when stacking has given splendid results this season, whilst in several instances the system of placing the butts outwards throughout has not resulted as desired.

Kameruka Silos.

At Kameruka, silos play an important part in keeping up the milk supply. Mr. Scarvell, who was in charge of the estate at the time of my visit, informed me that at one time, when they had to stop the supply of silage and feed on steamed lucerne chaff, the milk supply went down considerably, and was partly restored on the return to silage fodder. Altogether there are some twenty-eight silos on the estate, chiefly of the stave-tub type, costing somewhere about £100 each silo. There are two to each dairy, built close to the milking yards, and on the same principle as the twin silos at the Hawkesbury Agricultural College.

The photo. shows two of the first silos built on the Kameruka Estate, each holding somewhere about 120 tons. They have been up some years, and are in an excellent state of preservation. Unfortunately the estate lost some stock during the past year from lead-poisoning, owing to the silos having been painted inside with red lead. The addition of the lead was not necessary; the oil is what is needed chiefly, a coating of linseed oil or wood-

preserving oil being of great service in prolonging the life of the silo. There are a few fibro-cement silos on the estate, but although cheaper they are not thought so much of as the stave-tub.

Mr G. Grey, Kiama.

The question of filling the silo appears to stop a great many from making the venture. Some have said to me, "Oh, I would have a silo if you could show me how to fill it cheaply; I can't afford an engine." It certainly is a point for the small farmer to consider.

Now, on most farms there is power of some sort—very often horse-power. Mr. G. Grey, of Kiama, a hard-working and up-to-date practical man, made use of this style of power very effectively, He drove a chaff-cutter with horse power, and the elevator with a pony-works, making a capital job of it. He has a galvanised iron silo. The framework is of wood, the iron (plain galvanised) being nailed on on the inside. It is not a type of silo likely to last as long as some of the other types, owing to the likelihood of the iron corroding, unless well attended to; and then there is the chance of knocking holes in it. However, it is cheaper than most others, and judging by the sample which I saw at Mr. Grey's, it turns out splendid silage.

Mr. G. Lindsay, Dapto.

Among those who have given the question serious consideration in Illawarra is Mr. G. Lindsay, of Horsley, Dapto. Mr. Lindsay carefully studied the different types of silos, and eventually decided on the ferro-cement, which is really a reinforced concrete. It makes a most durable silo, and turns out splendid silage. I understand from Mr. Lindsay that his silo holds about 120 tons, and cost £1 for every ton capacity; and it certainly is a type of silo which one could recommend. It could be erected at much less cost were farmers to combine and have their own moulds. The framework is of steel uprights and bands, with No. 8 black fencing wire woven around it. When this structure is complete, moulds made of galvanised iron are screwed together around it, and the cement floated in. When a section has dried sufficiently to sustain itself, the moulds are unscrewed and put up higher, and another section erected. In filling the silo Mr. Lindsay used an ordinary chaff-cutter and an elevator driven by steam.

The illustration shows Mr. Lindsay's silo after it had been practically emptied.

Mr. J. W. Gorrell, Unanderra.

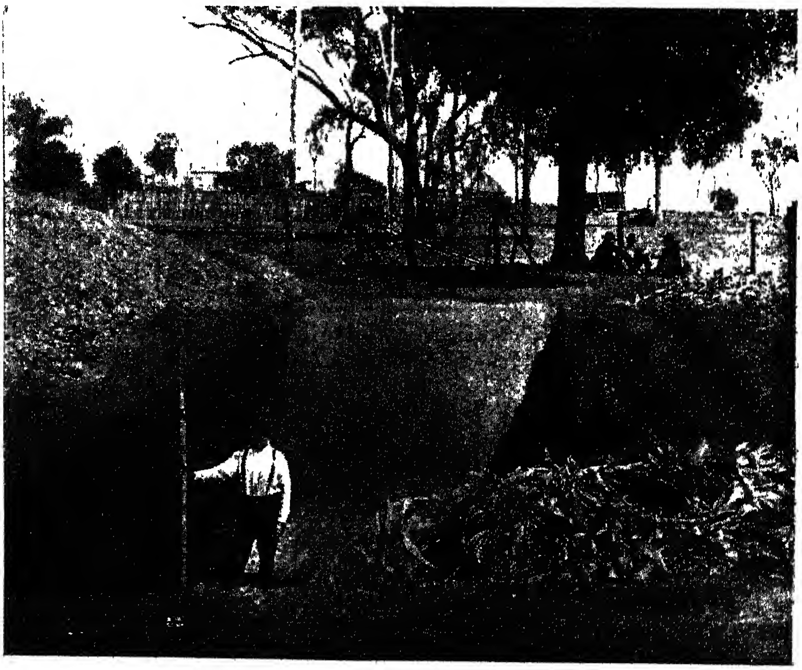
Mr. Gorrell, who erected a 100 tons silo last autumn, which he filled with corn and Japanese millet, speaks highly of the results. He writes:—

> Before the rain I was feeding twice a day on good Planter. As the ground became too wet, I stopped the Planter and gave the cows, forty in number, a little silage twice a day. Within two weeks the milk had increased 10 gallons per day, whilst my neighbours' cows went back in their milk.
>
> I am quite satisfied that there is no fodder equal to silage for producing milk. The quality improved, as well as the quantity. I intend to have another silo erected this summer, and will fill both in the autumn.

Silage in the Western Districts.

MARK H. REYNOLDS, Inspector of Agriculture.

OF great import to success in agriculture is the conservation of a portion of the crops, in a season of good rainfall, either as hay or as silage, and the holding of a proportion for future requirements. The periodicity of wet and dry seasons has not been proved by past records, so the agriculturist should be ever ready for a dry spell. The loss of stock, and the hardships suffered by farmers in a dry season, are constantly being brought before us; worse still, poverty and failure are at times recorded.



Pit excavated by Mr. Iram Nash, Parkes, for conserving fodder from Government Forage Plots.

It cannot be said that farmers, as a rule, are unmindful of the necessity of accumulating forage whenever possible; but the general method of conserving oaten and wheaten crops is in the form of hay, and the sharp edge of necessity for future requirements is often blunted, or the speculative instinct overcomes sound practice, by the offer at times of high prices for the hay so conserved. Thus it is not uncommon to find farmers facing a drought with little or no hay reserve. Silage, on the other hand, is not at present a trading article for distant markets. The majority do not include silage

making from winter or summer crops in their operations. This is not as it should be, for, irrespective of its feeding value, the succulent nature of silage makes it invaluable for animals suckling their young, and for farm animals when green herbage is not obtainable, its laxative properties adding to its value.

The fact that crops are in the best condition for ensiling during slack periods on wheat and sheep farms, viz., August to October, for winter crops, such as wheat, oats, barley, and rye; and January to March for summer crops, maize, sorghum, millets, and cowpeas, brings this method of conserving fodder within the reach of all.

The weather conditions over a large extent of the Western wheat-zone are, generally speaking, favourable to the growth of either winter or summer-growing crops for two out of every three years. In addition, herbage attains a growth at times which well repays harvesting.

Still, there are men on the land who believe that it is useless trying to grow such crops as maize or sorghum in any locality with a rainfall of less than 30 inches per annum. It has been demonstrated that these crops withstand dry-weather conditions to a degree enabling them to be grown with success in a 20-inch rainfall area. The degree of success to be obtained in so-called dry districts depends, amongst other factors, upon atmospheric conditions (humidity, direction and velocity of winds, and temperature); period and amount of rain precipitation; and suitability of the soil-composition (depth of surface soil, subsoil, water capacity, and retentive power for

Sorghum saccharatum on Government Forage Plot, Parkes.
Land summer fallowed; seed sown, 6th October; crop harvested, 9th to 11th March; yield approximately, 14 tons per acre.

moisture). Then it must be remembered that cultivation of the soil during the time the crop is growing, not only keeps weed-growth in check, but, by reducing the surface tension of the soil, minimises evaporation.

The Place for Forage Crops.

There are few farms where there are not acres of land too "strong" for the best results in grain production. Such rich localities should be selected for growing summer or winter forage crops. Abundant vegetative growth in wheat or oats would be more profitably harvested for hay, or to conserve as silage, than left for grain. This applies especially in areas with a deficiency of spring rains.

When the growing of forage crops for silage becomes a regular practice, it will be necessary to include them in a rotation of two or more years, embracing fallowing, which is necessary in low rainfall areas to accumulate moisture in the soil, and necessary in both wet and dry districts to clean the land. In a rotation, the area devoted to silage purposes should be enriched if necessary to produce a good vegetative growth.

Fortunately in this country we have not to store up for seven lean years like the Egyptians of old. If our farmers carried twelve months' supply of forage for their stock, the seriousness of droughts would be minimised. When it is stated that from 6 to 20 tons per acre of green crops have been harvested, that 10 acres of maize or sorghum will produce 100 tons of silage, and that 20 acres of wheat and oats will produce a like amount, the proposition of conserving a sufficiency is not a big one. So as not to unduly interfere with the work necessary in the main revenue-producing lines, such as grain, mutton, wool, beef, butter, &c., it is not suggested that farmers should go in extensively for silage-making during any one year.

Amount of Silage to Conserve.

The amount of silage to be conserved depends upon the number of stock the farmer carries on his property. Sufficient oaten and wheaten hay should be retained on the farm for the working horses, to maintain them to the next hay season.

Silage is suitable for working horses. I myself have fed horses with silage, mixed with chaff, in a dry time, and similar instances have come under my notice. However, I am considering silage especially for cattle and sheep, for which it is so well adapted. Generally speaking, a full ration of silage is not the most economical, but the feeding value of the silage depends on the stage of maturity when conserved, and the degree of fermentation which it has undergone in the process of ensiling. Therefore, no hard and fast rule can be laid down as to the amount of other food ingredients, such as lucerne hay, bran, &c., to be added to make a perfect food. Also much depends on the class of stock, and on the stage of maturity of the stock. Milking cows, or ewes with lamb, require the largest addition to silage of foods rich in protein.

Any Western farmer who conserves a quantity of silage sufficient to carry the whole of his live-stock for a period of twelve months, independent of the

carrying capacity of the pasture on the farm, will never regret the labour and expense incurred. A basis of calculation on the safe side would be to provide a daily allowance for each head of large stock of 50 lb., and of sheep 5 lb.

A well-balanced ration would consist of about 40 lb. maize or wheaten silage, and 15 lb. lucerne hay; or 40 lb. maize or wheaten silage, 10 lb. lucerne hay, 3 lb. bran.

Planter's Friend on Forage Plot at Gilgandra.

A crop converted into silage may be estimated to lose 30 per cent. of its weight. In other words, 100 tons green fodder put into pit or stack, if well conserved, should produce 70 tons silage. A calculation of weight can be made from the space occupied by the silage after it has been in the stack eight weeks. Every cubic foot will then weigh from 45 to 50 lb., variation in weight being due, among other causes, to maturity of fodder when ensiled, texture, composition, moisture, temperature, and weight added. Thus, on an average, one ton of good silage will feed 44 head of large stock daily, or 450 head of sheep. On this basis, 183 tons silage will feed 44 head of large stock, or 450 sheep, for six months.

Methods of Conserving Silage.

There is now no question that conserving the fodder chaffed in air-tight, deep pit or tub silos, preferably cylindrical in shape, is the cheapest and most workable method in the long run. The waste is reduced to a minimum, the temperature is better controlled, ensuring the maximum feeding value at present obtainable, and the silage is easier and more expeditiously handled.

The system followed at five of the demonstration plots was to conserve the fodder in stacks, this being the method of least initial expense. Silage being a new proposition to many farmers, the initial cost is of first consideration. The value of the conserved fodder in a time of shortage will incline them to improved methods whereby the percentage of waste may be minimised. Instances are not uncommon where the outside waste in stacks of silage is eaten by stock without ill effects, but the food value is low, and the stock are also in low condition when they eat it.

Silage Experiments.

During the past season it was decided to utilise the maize, sorghum, and cowpeas grown on some of the Forage Experiment Plots conducted in the Western districts for silage. When the crops were well grown, arrangements were made at certain places for the erection of four posts, placed generally 14 feet x 16 feet apart, at right angles, to act as guides in the building of the stacks. These posts were 20 feet out of the ground. One corner post was set 4 feet in the ground, and was of sufficient strength to carry a guy or lever (the latter was used), to lift 5 cwt. of fodder at a time. The posts were erected in close proximity to the crop to be ensiled. At Parkes, Mr. Nash excavated a pit for the reception of the fodder.

Silage Pits.

As shallow pits are perhaps the most satisfactory method of conserving silage, considering the initial expense, a short description of the operations and length of time occupied by Mr. Nash's two sons in preparing the pit will be of interest to farmers.

The site for the pit was chosen in the corner of the paddock where the crop to be ensiled was growing. It is sufficient distance from the fence to be worked on all sides.

The surface excavated was 60 feet x 12 feet, the earth being removed to a depth of 7 feet 6 inches for 25 feet. The bottom measurement of the pit was 25 feet x 12 feet, with a batter at either end of, roughly, 2 in 1 to the surface. Two young men, with two scoops, a single-furrow plough, and horses removed the earth from the pit—approximately 140 cubic yards—in 4½ days. The walls were trimmed with spade and mattock within this time. The horses were yoked tandem to the plough, with long coupling chains from horse to plough. One man led the horses, and the other controlled the plough. In this way they excavated the pit so as to leave an almost perpendicular wall.

In filling this pit, the fodder was tipped in from one side until it was possible for a team to haul the fodder into the pit. On completion, portion of the earth removed was distributed over the fodder with scoops.

Mr. Glasson, of Cumnock, suggests shallow excavations, 4 feet deep, on the side of a hill or sloping portion of ground, so that the bottom of the pit will be opened out on a level with the lower portion of the slope. This method obviates accumulation of water in wet weather when portion of the silage has been removed, and also renders unnecessary the erection of a roof over the pit. Where sufficiently steep slopes occur, the method might be followed with advantage.

Cutting Yellow Dent Maize at Parkes with a mowing machine with back-delivery attachment.

Location of Stack or Pit.

The location of the silage stack requires consideration. The site should not be liable to surface wash, floods, or soakage from the surrounding country. The same attention is necessary in locating a pit. Where the subsoil excavated is uniform in formation and characteristics, there has not, to my knowledge, been any damage to the silage from soakage into the pit, whenever the precautions mentioned in the selection of the site were taken.

Two instances have come under my notice where a white pipeclay underlay a stiff red-clay subsoil. The excavation was continued into underlying shale for some feet, but the soakage from the white clay bands needed constant attention. This trouble continued after the pits were bricked and cemented, but was overcome in one instance by placing joists in the bottom and covering them with flooring boards, and excavating a small well on one side to hold the accumulated drippings. A pump was permanently fixed for the purpose of pumping the pit out occasionally. In the instance where this was not done, the silage was spoilt.

I would suggest to farmers who find, after sinking some distance, that the pit is leaking from any stratum of soil, to cease deepening, or get the desired depth in the silo by erecting above ground, or else to make some provision to remove the water when it accumulates. The risk of water soaking into shallow pits is not so great.

A dairy farmer should select a site for stack or pit handy to the milking and feeding yards. It would be better for this class of farmer to grow crops for silage as near as possible to the feeding place. Where it is a matter of

feeding silage to stock other than milking cows, the area under forage crops may be anywhere on the run, and pits may be excavated convenient to the crop.

Summer Crops Suitable for Silage.

Maize.—Of the summer crops suitable for silage, perhaps maize holds first place, although there are conditions where sorghum gives a better return. The small quantity of seed required per acre by the method adopted in the several Farmers' Forage Plots, the expeditious method of sowing by using a drill sowing three rows at a time, and the large return of fodder or grain, make one wonder at the very small area that Western farmers devote to maize. On each of the Government Forage Plots a trial was made with four varieties of maize, two early and two late maturing varieties. The former, Iowa Silvermine and Pride of the North, did not return a big crop of forage, and from the results at the various plots, it is safe to conclude that their special value is as early grain producers. Sown at the same time as the varieties Yellow Dent and Hickory King, the cobs were fit to pull for grain when the Dent and Hickory King were at the most profitable stage to cut for silage.

The method adopted in making silage at the different plots was to mix the dry with the green stalks, after first removing the mature cobs. In this way there was no necessity, in most cases, to add water to the dry stalks when stacking.

The coarse and very tall growing late varieties of maize are not necessarily the most suitable for silage, at least as far as Western conditions are concerned. The uncertain weather conditions there require maize to reach maturity, when spring sown, in from three to four-and-a-half months. A variety making a growth of 9 to 10 feet, and forming an average of one cob to each plant, when drilled in as before mentioned, appears to be the most suitable. Such a variety is Yellow Dent, which proved much superior to Hickory King.

Cowpeas.—Three varieties, Black, Clay-coloured, and White, were sown with each variety of maize.

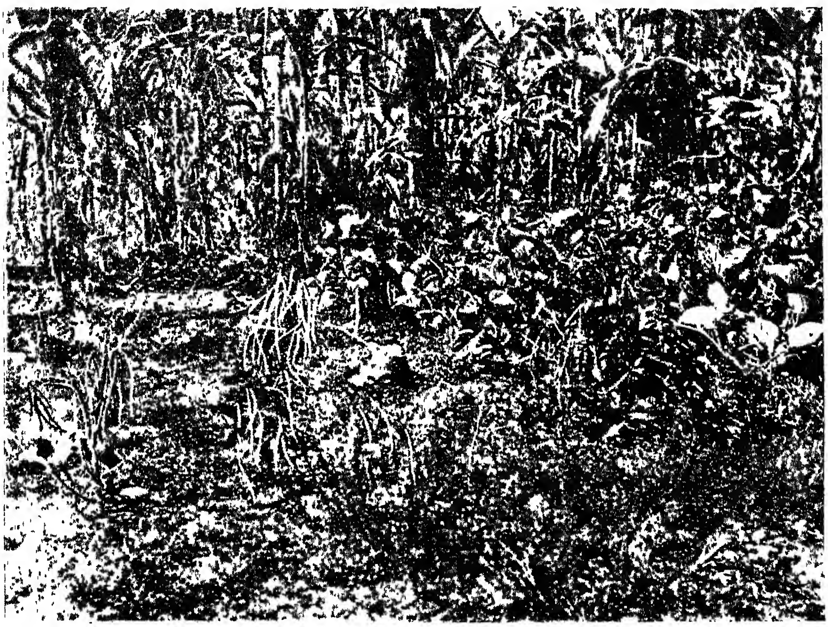
White ran to seed too quickly. At the time of cutting the maize, the plants had fully matured, and dried off. Further, it did not make a growth comparable with the other two varieties.

The Black variety proved the most suitable of the three, being well in flower and pod, and of good growth at time of cutting the sorghum and maize.

The Clay-coloured made the most growth, but was too late, only just coming into flower in most cases when the crops were cut.

One fact demonstrated in the various trial plots was that cowpeas make a better growth sown with sorghum than with maize. At Gilgandra, the intertwining of the cowpeas around the sorghum and along the rows to a height of 10 feet, was quite like the growth of tropical vegetation. Although the pea twined around the maize, it did so to only a limited extent, and there was only half the growth as compared with sorghum.

It is safe to recommend the inclusion of cowpeas with such fodder-crops as maize and sorghum, apart from their value as plant-food storers in the soil, and the fact that as the host of certain bacteria which fix atmospheric nitrogen, they increase the soil's fertility. The cowpea is a plant rich in albuminoids, and, added to maize and sorghum in silage, it materially increases the albuminoid ratio. Cowpea hay has a ratio of 1 : 3. Cowpeas and maize mixed as silage have a wider ratio, according to the proportion of maize used. A food with a ratio of 1 to 5 is considered necessary for the best results with milch cows.



Mr. Iram Nash's Forage Plot, Parkes.
White Cowpeas, dried up, to left of hat; Black Cowpeas to right; Maize in background.

The Time to Cut for Silage.

The time when maize can be conserved to the best advantage as silage is when the grain has attained its typical colour, showing the depression or dent in the grain, but is still soft. The stem is then green and sappy, but the outer portions of the leaves, from the cobs downward, have turned colour. Feeding maize to stock before tasselling, either green or as silage, is not only a wasteful process, but somewhat risky. Instances where stock have been affected by feeding on immature maize are recorded. However, the ill effects are slight compared with those from feeding on immature sorghum.

Sorghum should be cut when the seeds and husks on the flower panicles are the colour of ripeness, but not hard. The plant is then green, and the sap sweet.

With wheat, oats, barley, and rye—winter crops—cutting in any stage of growth has so far shown no deleterious effect when fed to stock; but, of course, there is a loss in feeding-value when cut too early. The best time to cut wheat and oats for silage is from flowering to the time when the grain is well formed; the forage being immediately carted into the stack. This is also the time to cut for hay. In practice, it would be well to start cutting before the anthers show from the ears, and stack or pit until such time as all available labour is required for haymaking and harvesting.

Frosts.

Planter's Friend was the latest maturing of the three sorghums tried on the six forage plots. For the three varieties to ripen together, it would be well to sow Planter's Friend at least a fortnight earlier than the others. This is practicable, as this variety withstands light frosts.

It is little known how much frost maize and sorghum will withstand in their young stages. At Orange in December three white frosts occurred. The maize and sorghum on the plot were at that time well above ground. The effect was to thin out the plants. The cowpeas were almost entirely destroyed; and the maize and sorghum, when cut in March for silage, were quite thick enough in the drills, and from 5 to 8 feet high.

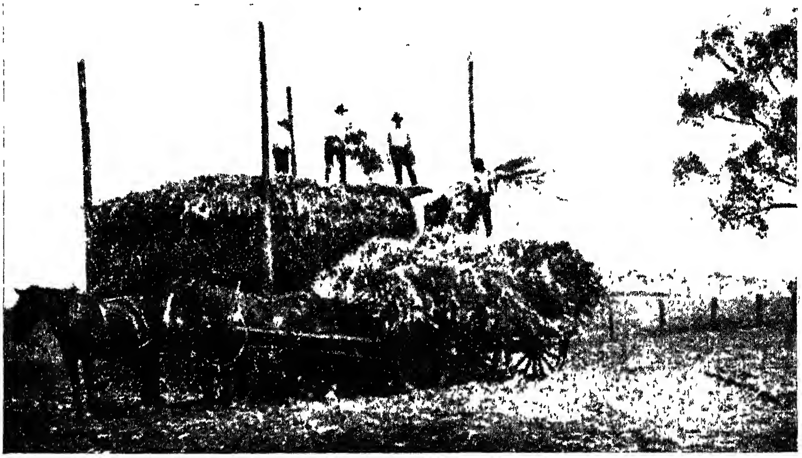
Growth Attained on the Plots.

At Mudgee and Gilgandra, the maize and sorghum attained a height of 9 to 12 feet, and returned 15 to 20 tons of forage to the acre. The shortest growth occurred at Orange and Narromine, 5 to 8 feet. The addition of cowpeas to the maize and sorghum did not in any case noticeably affect the growth of these crops. The application of fertilisers had no marked effect on the growth of the crops.

Harvesting Fodder Crops.

There have been on the market for some years now machines specially adapted for harvesting tall-growing crops, such as maize and sorghum. They are most satisfactorily used when the plants are in drills. The crop is cut and bound in the one operation, considerably reducing the labourers' work. With such a machine, 8 to 10 acres per day can be cut.

Attaching a strong scythe-blade to a sledge and drawing the sledge through the rows by horse-power, the blade cutting the stalks, is certainly better, quicker, and easier than hand-cutting; but it did not appeal to the Gilgandra or Narromine farmers. Portion of the crop on these plots was cut with such a contrivance. Men who have been accustomed to machines which enable them to quickly sow and harvest large areas of grain or hay, do not take kindly to slow and laborious methods of harvesting forage crops. The popularising of silage in the West will open up a field for the machinery merchant.



Silage stack-building, Towri Estate, Maryvale.

Stacking.

It is not an uncommon experience with farmers stacking hay for the stack to topple over. The trouble with hay is due to its non-adhesiveness, and the necessity of keeping the centre high, and also to the fact that temporary posts as guides are not considered essential by a "good" stack-builder. Otherwise, the uniformity in texture and moisture contents of the hay should make it easier to stack than silage.

It is a good rule to draw each load of hay to different sides. This also applies to silage. It is a mistake to load the stack from one side only.

Another point to remember in stacking forage is to make a complete layer of each variety of crop; and not, for instance, to place a deep layer of cow-peas on one side, and level up the other side with maize stalks. The varying proportion of moisture and dry matter must be considered in stacking.

Then, again, it is necessary, so as to conserve the largest percentage of fodder, or, in other words, to have a minimum of waste, to keep the base small, and build high. A stack on a base of 12 feet x 12 feet should not topple over if built 24 feet high.

Posts as guides in building a silage stack are essential to good work.

The butts, or tops, may be placed outward alternately, the point to aim at being to keep a central depression— quite the opposite to building a stack of hay.

Weighting.

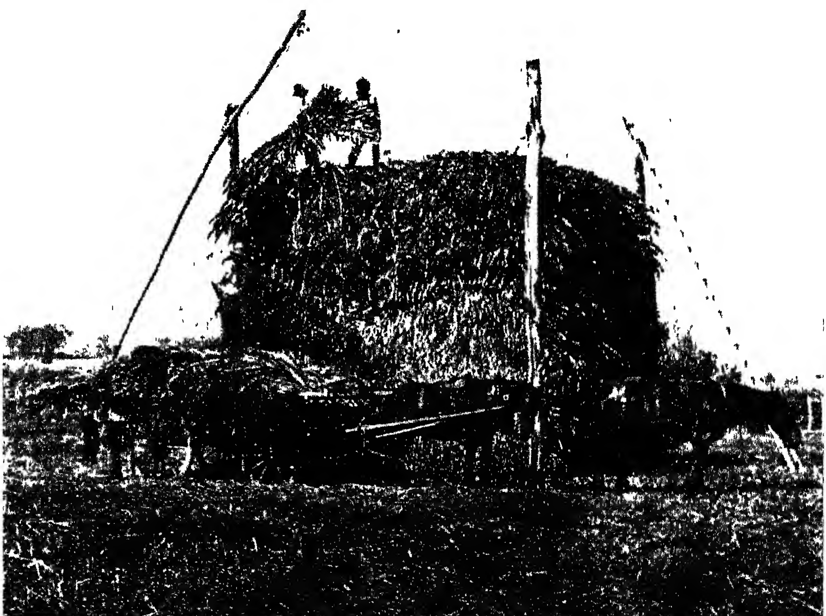
On completion of the stack, weighting is, in most cases, required. The weight required on a stack depends chiefly on the height the stack is built, the moisture content, the texture—coarseness or fineness—of the forage, and the length of time occupied in building the stack. With the pit at Parkes, as much as possible of the soil excavated was drawn in scoops on to the forage, to weight it.

As to the greatest and least weights necessary on green forage to obtain the best results, we only have very general statements to go upon. It is beyond question that in deep pit or tub silos, where the fodder is chaffed and the sides are airtight, a minimum pressure of about 20 lb. to the square foot of top surface is all that is required. In many cases no surface weighting is given, but there is always a layer, up to 3 feet, either mouldy or badly discoloured, under such conditions.

With stacks in which there are five sides exposed to the atmosphere, and where more air is impounded in the building than when chaffed, there is need for heavier weighting than is generally considered necessary. The weight is specially required for the top 5 feet, and should extend to the extreme limits of the top surface.

It may be said that the top 5 feet of green maize or sorghum place a weight of 160 lb. on each foot of surface of the fodder beneath. The drying effects are more pronounced on the top 5 feet, and on the outsides, than on the remainder of the stack.

It would be a safe practice when the stack is 15 feet high, to weight, either by suspending logs with cross wires, or directly adding weight on top (logs or earth), equal to 1 cwt. per square foot of top surface, when the crop stacked is maize or sorghum, in the stage recommended, to 10 lb. in the case of fine crops, such as lucerne. The finer and less mature the forage, and the higher built the stack, the less weight required. With shallow pits, weighting with earth is satisfactory.



Silage making at Mr. H. Caughey's Farm, Mudgee.

Roofing.

When the stack has been weighted, it is necessary to construct a roof of iron, thatch, or other material to protect the top surface from rain. During stacking, the effects of rain are not generally considered injurious. It is when the temperature is falling, and consolidation has almost reached its limit, that damage results to the silage through water entering the stack or pit.

Opening the Stacks.

Since the foregoing was written, two of the stacks, viz., those at Gilgandra and Orange, have been opened up.

At Gilgandra the silage was discoloured and mouldy for a foot on the outside of the stack. The remainder was of good quality and relished by the milking cows. Mr. Lithgow was so pleased with the silage that he is excavating a pit, and will this season sow 20 acres with forage crops, to be later conserved in the pit.

At Orange there was not sufficient fodder to build a fair-sized stack. This, together with other details, caused 18 inches of the outside of the stack to be discoloured and mouldy. Of the remainder, the maize conserved is of good quality and the sorghum fair. This silage is being sold to local dairymen. It is well to remember that stock fed on sweet hay, lucerne, bran, &c., take time to acquire a liking for silage, especially when it is fed to them for the first time.

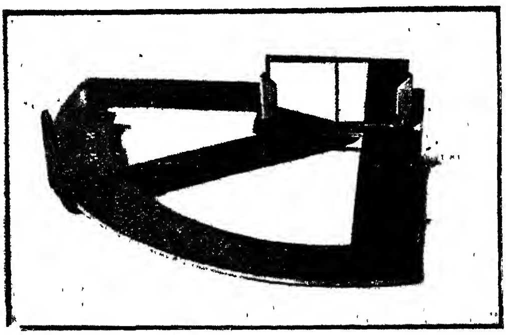
Pit Silo, forage covered with earth to right, Mr. Iram Nash's Farm, Parkes.

A Handy Surveying Instrument.

G. H. JOHNSTON, Acting English Master, Hawkesbury Agricultural College.

The great drawback to surveying on the farm up to the present has been the tediousness of making all surveys with the chain alone, instruments for the measurement of angles being so costly as to be out of the question for the man with a small holding. There has recently been introduced, however, an instrument, known as Murray's Patent Anglemeter, which bids fair to remove this difficulty.

The Anglemeter consists of a metal quadrant, at the angle of which is situated a mirror, which has a perpendicular unsilvered scratch at its centre. The arc is marked with a scale of degrees, from 20 to 180. A radial arm turns on a screw immediately under the centre of the mirror, and is provided at its outer end with a peep-hole, through which observations are taken. The instrument is really a modified sextant, the peep-hole serving instead of the telescope, and the single mirror being so placed as to do the work of the two.



The Anglemeter.

Its usefulness to the farmer lies in the fact that it can be employed to measure angles between fences, to lay out or test right angles, to determine heights of trees, and to determine the widths of rivers. A pamphlet is supplied with the instrument, giving very explicit directions for its use.

As far as it has been used at this College, it would appear that the only possibility of error lies in the position of the mirror. This is movable, and if its centre does not agree with the point on which the radial arm turns, errors are certain. It is advisable, then, before using the instrument for any important work, that the mirror should be fixed firmly in the correct position; and this is best done as follows:—

Set the radial arm at 90 degrees on the scale. Place the instrument on some convenient stand, such as a fence-post, and, sighting directly along the fence, have a rod placed at right angles. Invert the instrument, and have another rod similarly placed on the other side of the fence. If the mirror is in the correct position, the line from rod to rod should pass through the centre of the mirror. If the right angles are not correct, move the mirror slightly, and observe again, till at last the readings are found to be exact, then fix the mirror by means of splinters of wood wedged in at each end.

Once the mirror has been carefully secured in position, the Anglemeter will be found quite accurate enough for ordinary purposes; and since its cost is trifling, it should prove very valuable in farm surveying.

FORECASTING THE WEATHER.

TYPES OF DISTURBANCES.

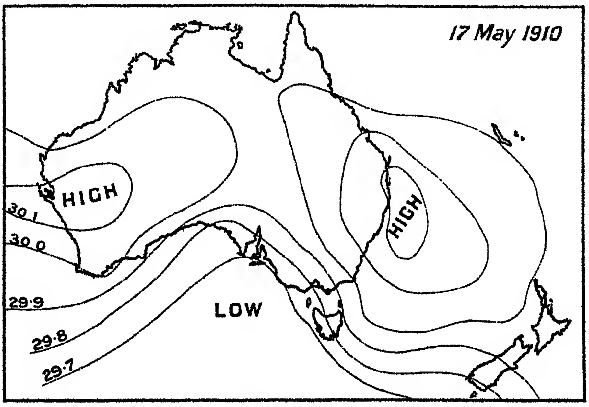


Fig. 1.
An Antarctic V Depression.

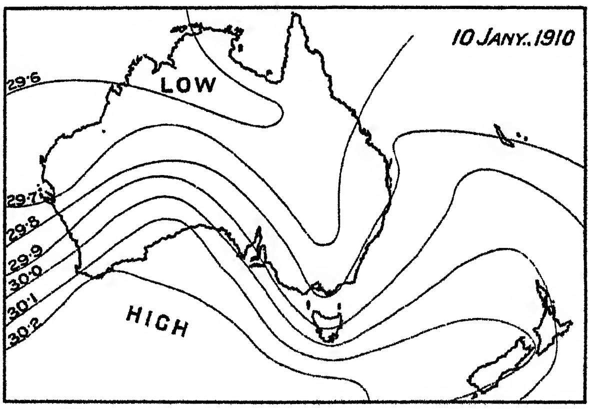


Fig. 2.
A Monsoonal Depression.

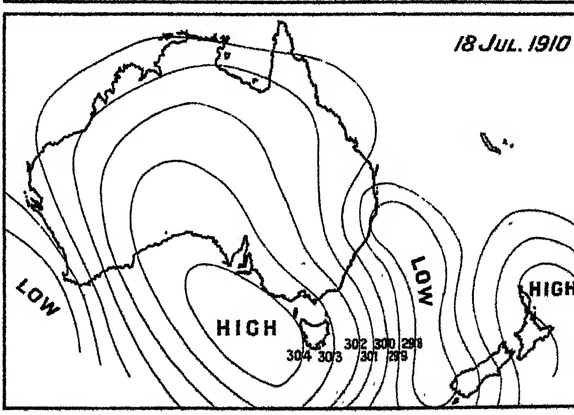


Fig. 3.
A North-easterly Disturbance.

Forecasting the Weather

STEWART WILSON, Divisional Officer, Commonwealth Weather Bureau, Sydney.

An outline map of the Commonwealth is published daily in the Press, showing isobars, or lines of equal barometric pressure, and a few notes are added with regard to the position of approaching disturbances. With the aid of this daily chart and an elementary knowledge of the principles of meteorology, it is possible for any person to obtain an approximate idea as to when and to what extent an approaching disturbance will affect his particular locality.

The first thing for an amateur to do is to obtain a reliable barometer and have it tested. He should then find the height of his residence above sea-level, so that his barometer readings will be comparable with those published in the daily papers; or, what is more to the point, with the isobars or lines of equal pressure in the weather chart. The height above the sea-level could be obtained from the nearest railway station or from a local surveyor. Roughly speaking, one inch should be allowed for every 1,000 feet above sea-level. For instance, if you live on the northern tablelands, say at Bundarra, with an elevation of 2,000 feet, your barometer would read 28·00 inches, as against 30·00 inches at sea-level.

With the aid of your barometer you can follow the different disturbances shown on the daily weather chart. You can see your barometer falling, and thus know that the disturbance is advancing towards you, with the prospect of rain. It is well to note carefully when the barometer reaches its lowest point, for as it rises the probabilities are that the rain is clearing.

The disturbances which bring rain to the inland districts mostly come from the westward, and from the north. The depressions from the west travel at an average rate of between 400 and 500 miles per day, and therefore take about six days to cross the continent.

In the winter, the southern half of New South Wales derives most of its rainfall from Antarctic or V-shaped disturbances, that is depressions which appear on the chart as an inverted V. As a rule, the further these V's penetrate into New South Wales the more general is the rain.

During the summer months the monsoonal depressions, in conjunction with the Antarctic disturbances, are responsible for most of the rainfall inland. These monsoonal disturbances travel at a much more erratic rate than the ones from the south. Occasionally they stagnate as much as a week or a fortnight over the Northern Territory, and it is therefore more difficult to foretell when they will affect New South Wales.

Another disturbance is often responsible for very good rains over the northern and eastern half of our State. This comes from the north-east, and usually travels at a greater rate than either of those from the westward.

It is generally heralded by a south to south-east wind, and falling barometer. The rapid falling of the barometer is a very important point and seldom fails to bring very good rains, accompanied by strong winds.

The three maps shown on the plate are typical examples of three different types of disturbances; they are the weather charts prepared on the dates shown in each case.

Figure 1 is a very good example of an Antarctic V depression. This disturbance was responsible for an extensive rainstorm over the greater part of the State, particularly the southern and western portions. The point to notice particularly with this type of disturbance is the rate of travel. With this particular storm the high pressure over our north-eastern districts stagnated to some extent, and thus interfered with the movement of the Antarctic low pressure, which only moved 300 miles in twenty-four hours, or just a little over half its usual rate.

Figure 2 shows a monsoonal depression which operated over New South Wales for a week, and resulted in good general rains, with some very heavy falls and thunder. It is one of the best monsoonal types possible to obtain. The chief characteristic to note in this storm is the distance which the tongue or "dip" penetrates south, as wherever the tongue is the rain follows, and thunder always accompanies the rain. The first three months of the year are the most likely time for the visits of these disturbances.

Figure 3 shows a storm of more recent date, which is typical of those which come in from the north-east. The first warning you receive is a falling barometer with a southerly wind; then follow strong southerly to south-easterly gales with heavy rains, chiefly over the coastal areas, though they sometimes extend over the northern and eastern quarters. With this class of disturbance the barometers are usually very high between Adelaide and Tasmania.

Export of Grapes.

With a view of testing the carrying qualities and values of grapes in Eastern markets, the Department of Agriculture recently forwarded to Colombo, Ceylon, two 20 lb. boxes of late varieties from the Wagga Experiment Farm. Particulars of the arrival of this shipment have now come to hand. There was a slight loss of weight owing to damaged fruit, but the cases realised a net price of about 17s. 4d. each. They were reported as being of "very fair quality, medium berries, green, nice bunches, firm stalks, little waste." Owing to their late arrival their value was about double the amount obtainable in the height of the Australian season. The Department considers the price realised as very satisfactory, and advises that growers of late table grapes in this State might with advantage avail themselves of this and other Eastern markets.

The Chemical Nature of the Black-soil Plains

WITH NOTES ON THE GEOLOGICAL ASPECT OF THE QUESTION.

F. B. GUTHRIE AND H. I. JENSEN.

[LAST year, Mr. L. A. Fosbery, of Wagga Wagga, drew the attention of the Department of Agriculture to a theory that the black-soil plains, such as those in the Coonamble district, may owe their geological origin to volcanic action—the flow of lava from active volcanoes falling into water, and acquiring the consistency of mud, during a partial submergence of the Continent. The following reports were prepared by Mr. Guthrie, Chemist of the Department, and Dr. H. I. Jensen, Assistant Chemist, and deal with the question from chemical and geological points of view.—ED.]

THE CHEMICAL NATURE OF THE BLACK-SOIL PLAINS.

F. B. GUTHRIE.

IN order to discuss this subject satisfactorily, I have collected analyses, made in the Department, of soils which may be regarded as typical of the black-soil areas of the north-western portion of the State lying within a circle bounded by Coonamble, Inverell, Moree, Collarendabri, and Walgett.

These soils are probably of alluvial origin, and include some of the richest grazing land of the State. A glance at the tabulated analyses will show that they possess certain well-defined characteristics in common, which distinguish them from the soil met with in any other part of New South Wales. None of them differ in any important particular from the average soil obtained by calculation.

They are all either virgin soil or grazing country.

The Walgett soil is not included in striking the average, this soil being of a much more sandy nature and differing in other characteristics, notably in its high content of lime.

The average thus arrived at represents fairly the general character of the typical black-soil country, which occurs extensively in the north-western portion of the State; watered by the Barwon and its tributaries, the Gwydir, Namoi, and Castlereagh. They are stiff clayey soils of low capillary power and highly retentive of water, becoming very sticky when wet, and very hard and cracked when dry. They cannot be said to be rich in vegetable matter, though their black colour is an indication of the presence of humus. Whether this black colour is due to a peculiar condition of the humus present, or to the condition of the iron-salts, is a matter for further examination. The nitrogen content is invariably low, but they are rich in mineral plant-food

particularly lime and potash, and are very fertile soils. Even a superficial observation of the nature of the native timbers, and the luxuriance of the herbage after rain, affords sufficiently convincing proof of their fertility. They are also deep soils, and often of considerable depth, so that they are not likely to be readily exhausted.

From their mechanical constitution they are to be classed as wheat lands. From an agricultural point of view, their principal drawback is the initial difficulty of getting them into good tilth, as owing to their being extremely sticky when wet, and drying to a hard surface, tillage operations are always difficult, and, except at the most favourable time—when they are in the right condition as to moistness—ploughing is practically impossible. Once broken up, the surface becomes friable on exposure to air, and their future cultivation presents no difficulties.

They are very commonly slightly alkaline in nature, but not sufficiently so to cause any trouble. They are not alkaline soils in the sense of the alkali plains of the Western States of America which have presented so serious an obstacle to cultivation.

In discussing the question of the use of bore-water on these soils, however, this fact must not be lost sight of, as the use of this water for any length of time will undoubtedly tend to exaggerate the defects already noticed, viz., their alkalinity, their deficiency in nitrogen, the sticky nature of the soil when wet, and its tendency to harden and crack when dry. Indeed, these peculiarities are just what one would expect if the soil had been subjected for a length of time to the action of alkaline bore-water.

Chemical Analysis of Black Soils.

Locality.	Moisture.	Volatile matter.	Nitrogen.	Soluble in Hydrochloric acid.		
				Lime.	Potash.	Phosphoric acid.
1. Coonamble	3·70	7·30	·116	·329	·295	·178
2. Wee Waa	3·68	8·73	·132	·488	·463	·187
3. Narrabri	6·83	6·34	·098	·725	·192	·237
4. Inverell	7·51	10·33	·111	·460	·152	·428
5. Myall Creek	10·50	10·71	·126	·823	·158	·389
6. Moree	4·17	5·85	·074	·769	·489	·086
7. Moree	9·70	6·10	·063	·640	·387	·074
8. Moree (cultivated) ...	8·13	5·29	·035	·760	·350	·091
9. Collarendabri	5·69	6·17	·050	1·000	·550	·040
10. Walgett	6·15	6·95	·071	2·766	·645	·180
Average (excluding the Walgett sample).	6·70	7·4	·089	·666	·337	·179

I attach Dr. Jensen's report on the geological points raised in Mr. Fosbery's letter.

Mechanical Analysis of Black Soils.

Locality.	Colour.	Nature of Soil.	Reaction.	Capacity for Water.	Roots.	Stones	Coarse Gravel.	Fine Gravel.	Sand.	Clay.
1. Coonamble	Black.	Clay	Slightly acid	77·	......	......	...	9·80	15·00	76·20
2. Wee Waa	,,	Heavy loam	Neutral	50·	......	......	0·33	3·93	46·91	48·83
3. Narrabri	Dark.	Loam	,,	48·	......	......	......	0·80	45·30	53·90
4. Inverell	Black.	Heavy loam	,,	62·6	0·08	......	0·33	1·08	32·66	65·85
5. Myall Creek	,,	Clay	Slightly acid	72·	......	......	......	1·46	17·60	80·94
6. Moree	,,	Very stiff clay	Alkaline	89·5	......	1·06	1·24	6·56	11·00	80·14
7. Moree	,,	,, ,,	Slightly alkaline	63·	......	......	0·66	7·66	13·33	78·35
8. Moree (cultivated)	,,	,, ,,	,, ,,	59·	......	......	0·93	9·40	18·00	71·67
9. Collarendabri	,,	Heavy loam	Alkaline	53·6	......	......	0·25	0·83	35·60	63·32
10. Walgett	Grey	,, ,,	,,	46·	......	......	0·46	1·13	56·05	42·36
Average (excluding the Walgett sample).	Black.	Heavy loam to clay	Slightly acid to alkaline.	64·	......	......	0·3	4·4	25·5	69·8

GEOLOGICAL ASPECT OF THE QUESTION.

H. I. JENSEN, D.Sc., Chemist's Branch.

From a physiographic standpoint, black soils may be divided into the following classes :—

A.—Black soils (peaty soils) occurring in swamps and swampy tracts along the courses of rivers. These consist of alluvium, either washed into depressions by streams, or deposited by river floods. Such soils owe their blackness mainly to the presence of carbonaceous matter and black compounds of iron produced by the reducing action of organic matter on the higher oxides.

When they occur in sandstone areas, as in the County of Cumberland, they frequently burn white, the main constituent, in addition to organic matter, being silica. When they occur in areas where volcanic or other rocks rich in iron abound, they burn red, owing to the oxidation of the ferrous compounds present.

Those which burn white are generally very deficient in lime and potash.

They are generally sour, and very acid in reaction.

B.—Black soils occurring on basaltic plains and tablelands—like the Darling Downs in Queensland, between Warwick, Cambooya, and Clifton. Such soils often cover great areas, and form black-soil plains, as in the case mentioned, and also at the Mullally Plains, between Gunnedah and Coonabarabran, and great portions of the Liverpool Plains, New South Wales.

These soils owe their blackness to an abundance of lime in the parent rock, the presence of which in the soil favours nitrification and the reduction of iron, and also accelerates vegetable growth, and consequently increases the amount of humus.

These soils are very fertile—among the best in the State. They are usually neutral, or slightly alkaline, or weakly acid where they occur in depressions.

Similar soils, but thinner, occur on the slopes of basaltic mountains.

C.—Black soils of the alluvial black-soil plains of the west. These are characterised by the beautiful myall (*Acacia pendula*). *Eucalyptus Woolsiana*, one of the western so-called box, and the silver-leaved ironbark (*Eucalyptus melanophloia*) also occur on this kind of soil. This type of black soil is more loamy than class B, an evidence of alluvial origin. In some cases the alluvial black soils, or river country, consist of sediment deposited by rivers after being carried hundreds of miles, and derived from geological formations of varied character, and distantly remote. An abundance of lime, humus, and organic ferrous salts probably accounts for the black colour. Though very sticky in wet weather (owing to the minuteness of the particles composing the detritus), these soils dry more quickly than the black soils derived from decomposition of basalt *in situ*.

I have met with alluvial black soils of the nature just described along the banks of the Namoi River from Narrabri to Gunnedah, and I am told that they cover a vast area at Moree.

A subdivision of this type of black-soil plain is that composed of detritus brought by mountain streams from areas consisting of basic igneous rock. Such soils are more loamy and pebbly than those formed by decomposition of basic rocks *in situ*. The trees covering them are a mixture of those typical of B. and C. proper. In most cases the basaltic detritus was deposited at a period (late Pleistocene) when the climate of Australia was much wetter than at present, and when large areas were covered by inland seas.

Small and rapid streams, descending from mountainous regions of basic igneous rock, would deposit their burden of sediment as soon as the level country was reached, and the speed of the stream consequently lessened. Black-soil plains of this nature occur to the west of the Warrumbungle Mountains, at Tooraweanah, Tondeburine, and Tenandra; and north of the Warrumbungles at Goorianawa and Kalga; also west of the Nandewars in several places (Bobbiwaa Creek, &c.). The alluvium in these cases is mainly of igneous origin, but has been redistributed by streams, many of which have now disappeared.

The following extract from my paper, "The Geology of the Warrumbungle Mountains," *Proc. Linn. Soc. N.S.W., Vol. XXXII, Part* 3, deals with the same subject:—

Outside the mountain region (Warrumbungle), we have the extremely poor and thirsty sandy soils of the Pilliga Scrub to the north, thickly timbered with pine (*Callitris calcarata*), and the vast black-soil plains lying to the west and south-west. Interspersed with the black-soil plains there are belts of wretched sandy soil of the Pilliga type. In some of the valleys in the mountains, as at Tondeburine and Tooraweanah, where basaltic detritus accumulates, and where wash from basic trachytes is deposited, there are miniature black-soil plains, in reality occupying the position of alluvial fans. From the close resemblance of the black soil in these valleys to that of the plains, in colour, touch, mode of cracking when dry, and vegetation, it seems very likely that the black-soil plains (in the area H.I.J.) owe their richness to detritus brought down from the Warrumbungle Mountains in the course of ages. The black soil of the plains contains deposits of coarse gravels and waterworn pebbles, made up partly of volcanic rock of the Warrumbungle type, and partly of quartz derived from the conglomerates. These coarse materials must have been carried down at a time when the rainfall was greater in the mountains than at present.

Wind action is an important factor in redistribution in these areas, but as the winds here are mostly westerly, they have not taken any part in bringing down the detritus which formed the black-soil plains. The wind, however, is an important distributor of pests. Almost every year produces a new variety of thistle or other noxious herb, which completely monopolises the plains for the season, and only dies out to give the monopoly to a plague of something else. The winds bring the seeds from the West. The rabbit also helps the invader by shunning it for a while, and feeding on the diet he is used to. It is probably due to the rabbit that prickly species of thistles, unsuited for feed, are getting the upper hand on the plains.

Black-soil plains are often devoid of forest trees. This is due mainly to the fact that they are inclined to become swampy in wet weather, and to scorch up, cake and crack in dry weather. Where the black soils are loamy, such trees as box (*Eucalyptus Woolsiana?*), silver-leaved ironbark (*E. melanophloia*), Kurrajong, wattles, and myalls are common.

In my paper on the Nandewar mountains, *Proc. Linn. Soc. N.S.W., Vol. XXXII, Part* 4, I remark:—

The wide black-soil plain expanses of Bobbiwaa Creek and Maule's Creek, with so gentle a slope towards the general plains of Narrabri and Tarriaro that the country might be said to be practically level, show clearly that a previous wet cycle cut gorges in an elevated conoplain and carved wide valleys. Then followed an arid cycle with disintegrated drainage, the result of which was the filling up of the valleys with the detritus.

The formation of the black-soil plains and the subsequent rejuvenation of the streams may bear a relation to the formation of a lake in the north-western districts of New South Wales, and its subsequent drainage through its waters finding an exit by way of the Murray River. The arid period probably followed this last event.

Of the Coonamble black-soil plains I have no personal knowledge, but I think that they are probably true river country, as the Narrabri-Tarriaro plains are. I cannot support the idea that they are volcanic in the strict sense of the word, although much of the constituent material may be volcanic detritus. Even as close to the Warrumbungles as Tondeburine, much of the black-soil country is alluvium brought down in late Tertiary time from the mountains.

To the south of the Warrumbungles (Gowang district) black soils of type B certainly cover volcanic flows from the Warrumbungles, and extend over a considerable area.

I have seen no evidence of such volcanic flows reaching out in the direction of Coonamble.

D.—Black Soils of Limestone Origin: Limestone yields very fertile black soils, the colour being due in all probability to the same causes as mentioned above, particularly humus and organic compounds. If limestone were ever found absolutely pure it would yield a soil deficient in potash and phosphoric acid, and also in iron-bearing colouring material. Usually, however, limestones contain several per cent. or more of mineral silicates, which supply iron and potash to the soil, as well as silica, and also a considerable proportion of phosphate of lime of organic origin.

"Molascuit," a New Fodder.

Mr. F. B. Guthrie, Chemist of the Department of Agriculture, recently analysed a sample of this fodder, supplied by Mr. Arthur H. Hasell, 2, Bridge-street, Sydney, agent for Messrs. Young Bros., Fairymead Plantation, Bundaberg, Queensland. The fodder is represented to be a preparation of molasses and young sugar-cane tops.

Mr. Guthrie's report is as follows:—

Moisture	17·68	per cent.
Ash	8·56	„
Fibre	4·07	„
Ether extract (fat, &c.).. ..	0·12	„
Albuminoids	2·90	„
Carbohydrates (by difference) ..	66·67	„
	100·00	
Nutritive value	69·9	
Albumenoid ratio	1:23·1	

Five Acres of Citrus Fruits.

A Living Area.

H. C. L. ANDERSON.

If ever New South Wales establishes a Legion of Honour for Agriculturists and Horticulturists, there will surely be a division for men who have made a living from 5 acres and under, during a number of years, and for the women who have nobly helped them to make homes, not houses or cottages or mansions, but homes in every sense of that sacred word. When that day comes there will be difficulty in choosing the best in the State, but "Glen Afton" will not be far from the first.

The Homestead. Mr. A. G. Brown's Orchard, "Glen Afton," Ebenezer.

There are thousands of such unpretentious but pretty and cosy homes throughout New South Wales, many of them of striking merit, especially among the fruit-growing districts within a radius of 40 miles of the metropolis.

I was much struck on a recent visit with the excellence of 5 acres of citrus orchard owned and cultivated by Mr. Albert G. Brown, of "Glen Afton," Ebenezer, situated on poor sandy and gravelly soil above the reach and beneficent influence of the Hawkesbury River, about 7 miles from Windsor, one of the earliest settled districts of the State. No one would expect to see such soil chosen for growing productive crops; but the result has justified Mr. Brown's pluck.

The cultivation is perfect; the trees are admirably pruned on the American system, and are dark green in colour, and as clean and healthy as possible. There is a pretty home on the place, which reflects the taste, industry, and housewifely qualities of the "Better Half."

View of "Glen Afton" Orchard from roof of Homestead.

Outside western boundary, "Glen Afton" Orchard, showing the poor quality of the land.

There are far too many inflated figures about returns from orchards, which are published by men who do not tell the whole truth, and do immense harm by their over-coloured pictures. They get £2 from one pear tree, or £1 from one lemon tree, and forthwith multiply by 100, and assume, or let their readers assume, that the whole acre or the whole orchard bears at the same rate. We prefer to see the cash receipts for the year, and look at the net returns.

Mr. Brown's story, given in his own words, with some photographs, will interest and encourage many similarly situated. Suffice it to say that we have proof that the gross returns for the whole year 1909–1910 were over £200 from 5 acres—viz., £187 16s. 6d. from 283 citrus trees, and a few pounds from second crop; and £10 from a few peach trees—all included within the 5 acres.

"Glen Afton," Ebenezer.

"As nearly as I can say, eleven years ago, on the 6th July, I landed on the Ebenezer Common, on a homestead selection of 64 acres of poor land.

"When I had built a three-roomed weatherboard cottage, and excavated an underground tank, I had about thirty pounds (£30) in cash to fence, clear, and plant a one-acre orchard, and to go holiday-making upon, but I was fortunate enough to earn wages at 4/6 per day, which meant a very modest beginning. When my first acre had been planted, about 18 months later I managed to put out what now completes my present orchard, a total of 283 trees, 30 feet by 21 feet apart. This is a remarkably small number for the area covered, and a distance unfavourably criticised by many when first seen; but in view of the dryness of the run of seasons in this our Hawkesbury district, I think results justify this course. The space thus given has been a good standby to the grower.

Method of Working.

"I work on the old-fashioned lines, from the extremes of the foliage to within a foot of the trunk, and turn in well broken up farm-yard manure with the spade. The rest of the land is broken thoroughly with a five-pronged hoe. This work is done every year between the months of June and August. As soon as the spring weeds or weather conditions demand it, I use a light two-leaf iron harrow until the breaking-up season returns. Of course, be it understood that the harrow is used always after showers, as soon as the ground is in a workable condition. Underneath the trees for summer working I only use the Dutch hoe, an implement eminently adapted for my trees. Pruning is a matter of considerable importance to me; and, in passing, I desire to express my thanks to the Department of Agriculture for information under this head in the *Gazette*.

"The Baroni or Californian cut, for lemon trees in particular, commended itself as being better than anything I have met, and I immediately adopted it, and intend to continue till I find something better.

Lisbon Lemon, "Glen Afton" Orchard.

Emperor Mandarin, "Glen Afton" Orchard.

Drainage.

"This is a matter of which I cannot afford to lose sight. Underground drainage is too expensive for the poor man, so I formed surface drains, which are kept open summer and winter, between every row of trees, and as the land has a natural slight declivity, they answer my purpose.

"I have already stated that the land was poor. To give you an idea of the stone in this small orchard block, I have sold about 200 loads, and about 30 or 40 loads are dumped just outside the orchard. (This is flat stone.)

"Quantity of fruit exported last year:—610 packing cases and 41 gins, for which I received cheques totalling £187 16s. 6d. Fruit cases, railage, cartage and export cost £34 13s. 10d., leaving a net balance of £153 3s. 8d.

"I may state that the place I came to was a homestead selection, but owing to recent legislation I have managed to convert it into and pay for it as a conditional purchase.

"This I do not say boastfully, but thankfully: health and strength have not been denied me. My wife and two young friends who have resided with us for a number of years have never been wanting when help was needed in preparing fruit for market. To the house mentioned above, two rooms and a kitchen have been added at a cost of about £120."

In order to make a fair comparison of this soil with the average soils used for fruit growing in the County of Cumberland, an analysis of it has been made. It is a coarse sandy loam, containing ironstone gravel, 9 inches deep, lying on yellow clay, not at all a fertile subsoil.

The Chemist, in reporting on it, says:—

> This is an extremely poor soil, and will require a good deal of building up in order to get good results. It is a "hungry" sandy soil, very poor in plant food, and deficient in humus, and consequently unsatisfactory as regards its relation to moisture. Its water-holding capacity is low.

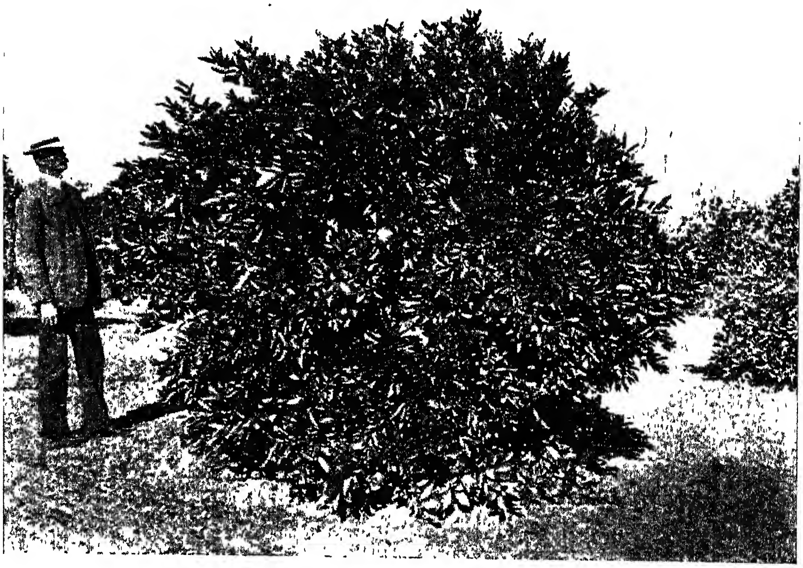
For the purposes of a full comparison, readers are referred to Dr. Jensen's article on "Orchard Soils of the County of Cumberland," in the June *Agricultural Gazette* of this year, page 461; but it will suffice for our present purpose to point out that the volatile and organic matter, which is so important an element in the fertility of any soil, is only 3·32 per cent. in the "Glen Afton" soil, while the average in the sandy soils of the county of Cumberland is 7·22, and in the shale soils 7·62 per cent.

The water capacity is only 39 per cent., as against an average of 45·2 per cent. for the county of Cumberland.

The capillary power, or the capacity for drawing water from lower levels, is 5·9 inches, whereas the average of Cumberland soils is 7·2.

In chemical constituents the soil is peculiarly poor. The *nitrogen* is ·021 per cent., which we term *deficient*; the average for the county of Cumberland soils being ·136 per cent., or nearly seven times as much.

The *lime* is ·040 per cent. (*bad*), contrasted with ·121 per cent., or three times as much.



Common Crange, "Glen Afton" Orchard.

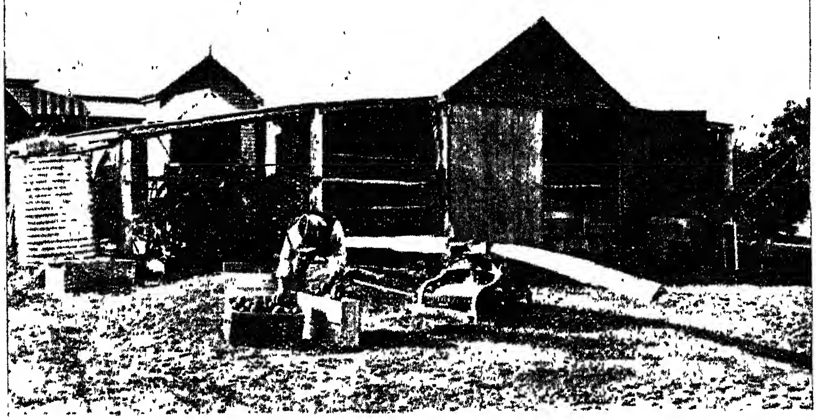
Branch of Orange tree, showing fruit, "Glen Afton" Orchard.

The *potash* is ·026 per cent. (*bad*), contrasted with ·099 per cent., nearly four times as much.

The *phosphoric acid* is ·073 per cent. (*fair*), contrasted with ·116 per cent.

However, Mr. Brown has made his success up to the present with the methods described in his own words above, and we can now advise him, and others similarly situated, as well as those who may have the pluck to follow his excellent example, to give special attention to the manuring of the land, first by ploughing in green crops—preferably peas and vetches—or by applying vegetable matter in any other form—stable manure, bush scrapings, or well-rotted compost—to make humus. This will make such a soil more retentive of moisture, and increase the living forces—worms, insects, protozoa, bacteria, and other forms of animal and vegetable life—which mean so much in promoting fertility.

The soil will also be very much benefited by the addition of lime (say half a ton per acre), and by the addition of potash in the form of sulphate, at the rate of 4 cwt. with each ton of bone-dust, which is used as a general fertiliser. These manures will keep the trees in good order, and improve the juiciness and sweetness of the fruit.



Packing Shed, "Glen Alton" Orchard.

Raising Potatoes from the Seed-berries or Fruits:

With Notes on certain other species of Tuber-bearing Solanums.

EDWIN CHEEL, Botanical Assistant, Botanic Gardens, Sydney.

The genus *Solanum*, which is one of the largest genera in the vegetable kingdom, and also one of the most important from an economic and commercial point of view, has received considerable attention at the hands of enthusiastic botanists and horticulturists in Europe and America, who have at various times made a special study of certain species, especially those of the tuber-bearing kinds. In this genus there are upwards of 900 names known to science, and of these we may safely consider about 700 to stand as distinct species.

Of this large number there are only about seven species or sub-species which are known to produce tubers, their names being as follow :—*

Solanum Commersoni, Dunal.
" *Jamesii*, Torr.
" *Maglia*, Schlechtendal.
" *polyadenium*, Greenman.
" *tuberosum*, Linn.
" *verrucosum*, Schlechtendal.
" *etuberosum*, Lindley.

The two last-mentioned species are considered by certain botanists to be only varieties of the well known *S. tuberosum*, which is the most important species from a commercial point of view, as it is from this species that our present potato of commerce is supposed to have been derived.

History of the Potato.

The history of the potato dates back to the early part of the sixteenth century, and it is reported to have been brought into Spain by the Spaniards, who invaded Peru under Pizarro. It was originally found in the Cordilleras, the high mountains of Peru and Chili.

The name "potato" is said to have been derived from the Spanish *batata*. According to some writers, it was first introduced into Great Britain by Sir John Hawkins in 1563, while others declare that it was unknown in England until 1586, when Sir Walter Raleigh returned from an unsuccessful attempt to found the Colony of Virginia.

Since that time the potato has made rapid progress in the number of varieties that have been developed under the skill of horticulturists, with the result that there are now known to be in existence upwards of 500

* An excellent Paper on these species is published by A. W. Sutton, F.L.S., in the Journal of the Linnean Society, London, Vol. XXXVIII, p. 446 (1909).

varieties which are distinguished by shape and colour, by their flavour and relative amount of albumen and starch, and also by their different modes of growth.

Tests of New Varieties.

New varieties are continually arising, especially in the older countries, and old ones are dying out and are being replaced by those new ones which are supposed to have improved qualities. Many of these varieties have been introduced into Australia, as may be seen from our nurserymen's catalogues, from which I have been able to list together the names of eighty-two distinct varieties, including a few introduced by myself from England.

In 1905, being on a visit to London, I had an opportunity of being present at the Horticultural Exhibition held at the Temple Gardens under the auspices of the Royal Horticultural Society of London, and among the numerous exhibits it was very pleasing to note a very fine display of tubers. Several of these were entirely new to me. They were extremely fine tubers, and I was able to secure a single tuber of six varieties, which I brought back with me to test their growing qualities in our New South Wales climate. These were accordingly planted, together with twenty-one other varieties, in September, 1905, and particulars of a number of the results were published in the *Sydney Morning Herald* of 8th August, 1906, p. 7.

It has been stated by some writers that the early varieties of potatoes very rarely produce either blooms or seeds; and having a number of varieties under cultivation I decided to watch their development to see if this statement would be borne out. In several instances I found that the early varieties produced the flower buds, but that they usually fall off before the flower is opened, and as a consequence they never produce any seed-berries.

In watching the progress and peculiar habits of twenty-seven varieties of tubers, I noticed that, although a number of them produced perfect flowers of various shades of colour, ranging from violet to creamy-white or pure white, in not a single instance were any berries formed; and although I grew the same number of varieties for three or four years in succession, I was unsuccessful in securing berries or fruits with properly matured seed from any of those grown.

Blue-eyed Russet.

In 1906, Mr. H. Cammamile, a resident of Penshurst, purchased some sets of tubers, of the variety "Harbinger," and when digging up the crop he noticed a peculiar roundish variety, quite distinct from the true "Harbinger," which had purple splashes in the eyes, and he referred it to me for identification. This has been compared, and is identical with the variety known as "Blue-eyed Russet." I have since found that the "Harbingers" were purchased from Messrs. Anderson & Co.; and as the "Blue-eyed Russet" was named and catalogued by the firm in 1906, it is probable that one of the "Blue-eyed Russet" tubers got mixed with the "Harbinger."

As this variety was new to me, I decided to put it on trial with the rest to test its growing and seeding qualities. In September, 1907, I planted this additional variety, and was pleased to find that the seed-berries were properly formed, and in due course matured a fair number of perfect seed.

Raising New Varieties from Blue-eyed Russet.

Having at last succeeded in obtaining some perfect seed, I was naturally anxious to germinate it so as to see whether the tubers would be produced like the parent, so instead of waiting until the following August or September before sowing the seed I decided to sow it at once. Accordingly, it was sown on the 13th of February, 1908. The seed, being new, germinated very freely in ten days; and when the seedlings were sufficiently strong to be handled, I was able to prick off from the seed-pan 103 seedlings into a specially-prepared bed in April.

As the seedlings developed it was noticeable that there was very great variation in their general habit of growth and in the foliage. Some had rather stiff, pale-coloured, upright stems, scarcely branched; while others had thin, purplish or reddish-coloured, wiry stems, either very much branched upwards or branching from a somewhat creeping stolon. There was also considerable variation in the leaflets, those of the upright growth being usually broader than those of the thin or wiry-stemmed plants.

Results of First Planting.

On the 12th of May—just eighty-eight days after the seed was sown—one plant started to ripen off, having apparently reached its fullest development and maturity, so I resolved to lift the roots to see the results of the tubers. This—the first to mature—produced four roundish, pure white-skinned tubers slightly larger than Yorkshire Hero peas in size. A second plant reached maturity on the 22nd, or just ten days later. This also produced whitish tubers, three in number, about the same size as the first plant. From this onward the rest were lifted as they matured, and the last was lifted in the second week in June. In lifting the tubers it was noticed that there was considerable variation, not only in the colour, but also in the shape and in the yield, which may be briefly stated as follows:—

Rounded whitish-skinned tubers, more or less splashed with purple in the eyes like the parent	31	roots.
Oval or oblong-shaped tubers, more or less splashed with purple	12	,,
Rounded, pure white-skinned tubers, with shallow eyes ...	24	,,
Rounded, pure white-skinned tubers, with rather deep, uneven eyes	3	,,
Oval or oblong tubers, whitish or faint yellowish-skinned ...	14	,,
Oblong, more or less flattened tubers, very faintly tinged with pink, especially around the eyes	8	,,
Oblong reddish-skinned tubers	1	,,
Without tubers	10	,,
Total	103	,,

The tubers varied very considerably in the number to each root; some producing only one, while others produced from three to four, the latter being the most general result. The highest in number from the first production was seven, from a wiry plant, the tubers being very small and distinctly tinged with purple in the eyes. When lifting the tubers, care was taken to keep the progeny of each root separate, so as to test the growing qualities of each plant.

Subsequent Plantings.

A second planting was made in September, 1908, and the crop was lifted in January, 1909. Several of the second planting failed to grow, owing probably to the tubers being too small; while others that did sprout were destroyed through the ravages of insect pests, the worst being the potato-moth (*Lita solanella*).

A third planting was made in March, 1909, and the crop lifted in June, 1909. A fourth planting was made in September, 1909, and the crop matured in December, 1909, and January, 1910.

In March, 1910, I made a fifth planting of part only, reserving some of the tubers for spring-planting in August or September. These have already (August, 1910) developed shoots from ⅛ to 1½ inch in length.

It will be seen from the results stated above that tuber-raising from seed can be advanced much more rapidly in the genial Sydney climate than it can in the colder potato-growing districts, and advantage can very well be taken of this by those interested in the potato trade.

Observations during the Tests.

In watching the development of the tubers, it has been interesting to note that each time the crop was lifted since the seedling stage, the tubers have so far retained the same characteristics as were noted in their infancy. That is to say, the small pea-sized tubers obtained from the seedling plants have developed the same characteristics as were noted when first obtained from the seed, as regards colour as well as shape. In a few of the seedlings with purple eyes, there is a tendency to produce aerial-tubers—that is to say, tubers are produced on the haulms in the axils of the leaves. Others show a tendency to produce the tubers at the extremity of long underground stolons. Some of the round, purple-eyed tubers seem to be more prolific in numbers than others. One white-skinned variety seems also to be very prolific in numbers, although they are not so large as other varieties which are similar in shape and colour, and have been grown in exactly the same class of soil. It will be interesting to follow the life-history of a few of these forms to see if they retain the same prolific-bearing capacity or tendency to produce aerial-tubers in a season or two hence.

Selection of Varieties.

It is known that a given variety may vary in yield in separate trials, but the general value of testing certain varieties in different soils and at different altitudes is a matter that has not yet received the attention that it should.

Differences in soils are responsible no doubt in many cases for the variation in yield of a given variety, but should be no criterion of what it may do on yet another kind of soil. It seems best that each grower should learn for himself just what variety is most suited to the particular soil on his farm, as very little is gained by watching the results of others when the soil may be entirely different on his own particular area. But accumulated evidence, from different sources, on a given variety, is well worth knowing, and may help one considerably in choosing a particular variety.

Improving our potato-crops by seed selection, and even by breeding from other species or varieties, is a matter of very great commercial interest and importance, as it costs no more to grow improved varieties than it does to grow those of inferior quality. Another matter of very great importance is the acclimatisation of different varieties to the conditions of soil and climate where they are grown, as many of our tillers of the soil suffer very great loss from the growing of varieties not adapted to their local conditions.

In seed-raising, considerable room for improvement exists in regard to quality, as distinct from quantity, in the production of tubers for commercial purposes, especially in this continent, which, owing to its vastness and varying climate, can easily hold its own as regards cropping power. But the selection of varieties which will give an increased yield or better quality is not the only matter of importance; it is becoming more and more necessary to study the different varieties in their susceptibility toward certain diseases.

Raising Disease-resistant Varieties.

It may be possible to select varieties of seedling potatoes which may show successful resistance towards the prevailing potato diseases, or in other words, "disease-proof varieties"; and this can only be brought about by selecting seed from the hardiest varieties, or by breeding from immune species. It has been emphasised by many of our leading scientists that in nature there are mutations so powerful in lines of new heredity, that from mutating individuals, new varieties and even new species may arise. Is it not possible that from among these we may expect to get an occasional plant—say one in a thousand or one in ten thousand—the blood of which has the power to produce an improved stock capable of resisting the attacks of certain diseases? It is a well known fact also that many of our fungus diseases are not intercommunicable—that is to say, certain diseases which attack one variety or species of plant will not attack any other variety or species. For example, in the laboratories of the United States of America, a series of experiments have been carried out with the wilt-disease of the cowpea, and it is found that it will attack nothing but cowpeas; and even amongst them some varieties are more resistant than others. The cotton-wilt has also been tested, and it is found that it will attack nothing but okra and cotton. Such being the case, it will naturally be interesting to see if we can produce a variety of potato which will resist the attack of the so-called Irish or Potato-blight, caused by the fungus known as *Phytophthora infestans*.

In this connection we should turn our attention to a closely allied species of our present cultivated potato, namely, *Solanum Maglia*, which is said to be able to resist the attacks of the potato-blight in its indigenous habitat in the low-lying swampy soil of the Chandos Archipelago; whereas the ordinary potato is practically destroyed by the potato-blight growing on wet soils in damp seasons in the same neighbourhood.

We should give some practical encouragement to those who are endeavouring to breed plants with hardy constitutions, powerful enough to resist the attacks of parasitic pests. Care should be also taken to check the output of weakly plants which are not able to resist the attacks of diseases.

Our present methods of combating fungus diseases are not only costly but very unsatisfactory, as after all we can only keep the disease in check, without effecting a permanent cure. This has been amply shown by the persistent efforts of experienced horticulturists and scientific men in Europe, who have been trying, but without avail, to kill out the potato-disease in Europe since its first appearance about 1845.

If we could produce a hybrid between our present cultivated potato and some other closely-allied tuber-bearing species, we might ultimately be successful in obtaining new forms, capable not only of resisting the attacks of the potato-blight, but also of yielding equally as good crop as the present varieties, and consequently enhancing the value of our potato crops per acre—especially if we could produce a variety that would mature its crop when the disease was not so prevalent, say early or late in the season.

NOTE.—Mr. Cheel supplied twenty-seven of these seedling potatoes, and asked that they be given a further trial in a good potato-growing district for at least one more season, to test their producing and also their disease-resistant qualities. He also supplied a few tubers of "King Edward VII" and "Lady of the Lawn," which he brought out from England in 1905. These seedling potatoes have been sent to Bathurst Experiment Farm, where they will be grown on the Irrigation Plot.

It may be mentioned that the Farm Manager, Mr. R. W. Peacock, already has several varieties growing on the Irrigation Plot which have been raised from the potato apple.—ED

Tamworth Lucerne Seed

J. E. O'GRADY.

THE Peel and Cockburn Rivers meet just to the south-east of Tamworth, forming the beautiful Nemingha Valley. For ages these two streams brought down with their waters fine washings from the granite and basalt hills, and deposited them in the valley, until a chocolate brown soil was formed, friable, and of wondrous depth and fertility. Upon this soil grew red, blue and white gums, and apple, in great numbers, the trees assuming gigantic size. But some fifty years ago lucerne was brought to Nemingha Valley. Gradually the trees have been removed from the loose soil, except where required for shade, and the king of fodder plants has come into his own

From an eminence on the Moonbi road, the valley presents a prospect not to be surpassed in the whole of this fertile State. Seen at the end of August, when the winter crop, unfitted for the best hay, was being removed for horse-feed, the view was a delightful one. Belts of trees marked where the two rivers made their way between steep banks across the flats, their underground waters bringing the necessary moisture to the deep-feeding roots of the lucerne. The valley was one broad expanse of rich emerald, except where bright orange patches marked the track covered by the mower. Upon the undulating country above the flats, the young wheat was just covering the ground with its light green mantle. The picture was set in a brown frame made by the steep Moonbi Ranges, and the whole formed a verdant panorama for which it would be indeed difficult to find a parallel. Residents smile at one's enthusiasm, and say that the full beauty of the scene is only attained when the lucerne fields, glistening in the warm sunshine, are covered with purple flowers, from which myriads of bees sip nectar to make the honey for which the district is renowned.

Some day an Australian poet will sing of that valley, and his lines will go forth to the world to correct the mistaken impression that this is a land of long, hot summers and disastrous droughts. But the poet will not be one of the tall sons of Tamworth. They know too well the commercial value of those fertile lucerne flats, and their energies are directed to more material purposes. The valley is made to belch forth six or seven crops of lucerne hay per annum, whilst in the warm month of February the Northern trains bring down many tons of Tamworth lucerne seed. Asked to place a value upon their land, the farmers become grave and thoughtful, but they give an emphatic negative to any suggestion of much less than £100 per acre. Several authenticated cases are known of rents of £3 per acre per annum being received for large areas.

Being anxious to obtain some information upon the growing of lucerne seed for a general Farmer's Bulletin on Lucerne, I communicated with Mr. T. G. Adamson, a fairly large grower of lucerne, wheat and barley, whose property, "Ngoora," is situated a couple of miles from Nemingha Railway Station, upon the Goonoo Goonoo Estate. By his courteous introduction, I was enabled to interview several gentlemen who have been identified with the lucerne seed industry for many years. Mr. Alexander Mathieson, the present Mayor of Tamworth, in addition to being a lucerne grower himself, has been threshing seed in the district for half a lifetime, and from long practical experience has become familiar with the problems involved in its production. Mr. W. J. Laidlaw, whose property is at Moonbi, on the Cockburn, has had twenty-six years' experience as a lucerne grower, and has gained several important prizes with samples of lucerne seed. The opinions of these gentlemen may be taken as thoroughly reliable advice upon the matter.

The Soil.

The following notes are extracted from a report made by Mr. F. B. Guthrie, Chemist of this Department, upon the analysis of a sample of soil from Mr. Adamson's lucerne flats. The land is so friable that during the clearing operations holes were sunk 8 feet deep without the use of the pick. A well upon the property is 20 feet deep, the soil being composed of bands of loam throughout, until gravel is struck, with water in abundance. This soil presents the ideal conditions for lucerne, and any farmer possessing land approximating to this should know what to do with it.

Analysis of Soil from the Valley of the Peel River and Reedy-Creek, adjoining Nemingha Valley, Tamworth.

Geological formation of surrounding country: Granite and basalt.
Nature and depth of soil: Friable clay, very deep.
Colour of soil: Brown.
Reaction of soil: Neutral.
Capacity for water: 54 per cent. Good
Absolute weight per acre, 6 inches deep: 1,520,635 lb.
Capillary power: 4·8 inches. Fair.

Mechanical Analysis:—

Root fibres	·00	per cent.
Stones over ¼ inch diameter	·00	,,
Coarse gravel, more than 1-10th inch diameter	·00	,,
Fine gravel, more than 1-15th inch diameter	·34	,,
Fine Soil { Sand	7·00	,,
Fine Soil { Impalpable matter, chiefly clay	92·66	,,
Moisture	6·58	,,
Volatile and combustible matter, principally organic ...	11·78	,,

Percentages of Fertilising Substances:—

Nitrogen	·175	Good.
Lime	·738	Very good.
Potash	·270	Good.
Phosphoric Acid	·235	Good.

Remarks:—

This is a very rich soil chemically, and although nearly a pure clay, is of a very friable nature, and should offer no difficulties in the way of cultivation. It possesses a very high nitrifying power. No special treatment should be required beyond good cultivation, nor should any manuring be needed for a few years. It is very rich in all the elements of plant food, and being well supplied with humus, and of good water-holding capacity, the plant food is in a readily available condition. It should give excellent results with lucerne or wheat, or indeed any crop suitable to the district.

This will give readers an idea why lucerne thrives at Tamworth The country is some 1,200 feet above sea-level, and the rainfall about 27 inches per annum. The deep, rich, friable soil, with its underground water, provides all that the plant requires for hay production, whilst the warm summer temperature aids the ripening of the seed crop. But lucerne seed is not grown without difficulty, and the most careful judgment, based upon long experience, cannot eliminate the elements of uncertainty. The market price of Tamworth seed is therefore high.

The Uncertainty of the Seed Crop.

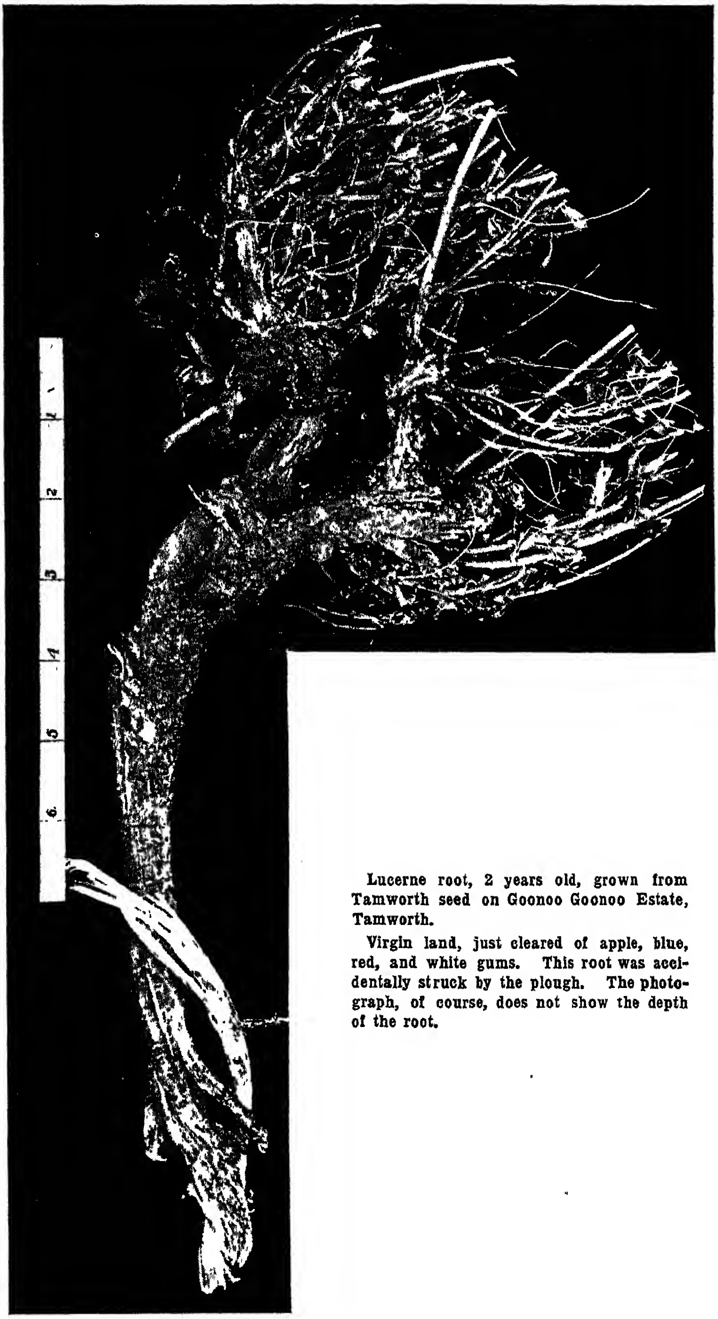
Nobody at Tamworth plants lucerne with the special object of growing seed. The plant is grown for hay, and one crop, or occasionally two, are allowed to go to seed, when the grower, in his judgment, deems the conditions suitable. If his judgment has been correct, his bank account receives a sudden rise; otherwise it drops a little, but not much. The venture, however, is not entirely a gamble, as some growers of experience claim to be able to judge the conditions with considerable accuracy. Still, the weather is the main governing factor, and a very trifling meteorological derangement often upsets the most carefully-considered attempt. Mr. Mathieson gave the following illustration:—

A man may cut portion of his crop for hay in the beginning of December, with the object of getting a seed crop in February, and another portion a week later. The first seed crop may be a failure, and the second one a success. There is something in the weather conditions which affects the plant when it starts to come into flower, and sometimes a week's difference in the flowering stage alters the result altogether. A man has to use very much judgment, and no hard and fast rules can be laid down, even as to the weather conditions You must watch the crop, even when it is ripening, and use great judgment as to when the greatest part of it is ripe, as it does not always ripen evenly, and the seed crop must not be allowed to stand after it is fit to cut.

The Age of the Plant.

Mr. Adamson mentioned a case where a grower got a crop of seed the first year after planting his lucerne, but it is wiser to wait until the plants are three or four years old. Mr. Laidlaw's opinion is as follows:—

A thin crop is the best for seed. An old piece of lucerne which is not growing very strongly, or a crop growing weakly on a poor piece of ground, will often give good results. I got excellent seed from a paddock that had been growing lucerne for sixteen years without reploughing. But some years you may get good seed from both young and old crops. We once got a beautiful crop from three-years-old plants in the third cutting; but I prefer old lucerne for seed. It gives a better sample, and I think it is heavier. It seems to be a better quality of seed. An old plant will also carry more seed.



Lucerne root, 2 years old, grown from Tamworth seed on Goonoo Goonoo Estate, Tamworth.

Virgin land, just cleared of apple, blue, red, and white gums. This root was accidentally struck by the plough. The photograph, of course, does not show the depth of the root.

Mr. Mathieson's views are similar :—

You will get a better seed crop from old lucerne than from young plants. In some seasons you may get a crop the first year, but it is not advisable to attempt it. It should be at least three or four years old. The young plant will go to seed, but the grain is very small and the yield light. As the field gets older the plants thin out, and those which remain become stronger, carrying a better crop of seed. I cannot say that seed from an older plant is healthier, but it is larger, and consequently may be expected to germinate better and give a stronger growth.

The Crop to Save.

Generally speaking, the third crop of the season is the one allowed to go to seed, the second hay crop being cut early in December. In the Valley hay crops are obtained every five or six weeks during the growing season, but the seed crop requires about double the time to mature, and is left for ten or twelve weeks. This brings the harvesting about the end of January or in February. The reason for selecting this crop is, according to Mr. Mathieson, that, if the season is at all moist, this crop has the heat of summer upon it, and is checked in its growth by the dry weather. There is also less likelihood of a second growth commencing. A succulent plant will not yield much seed ; it is the slow-growing crop, with the heat of summer to harden its stalks, which can be most safely depended upon.

Still, when the season is particularly favourable, the second crop is sometimes left for seed. But this is a more risky proceeding, and the crop must be closely watched, to see that the flowers are setting and that it has a healthy bloom. Provided these conditions are fulfilled, and the weather continues favourable, a good yield is sometimes obtained from the second crop. Again, good seed may occasionally be obtained from the fourth crop, if the conditions in January are against the third crop seeding and it is cut for hay. The autumn may be a favourable one, and the fourth crop may yield good seed. In some seasons growers have obtained two good seed crops. But a man requires to be level-headed to be successful with lucerne seed.

Fertilisation.

When a grower is cutting his crop for hay, he puts the mower on when the plants are just coming into bloom ; but if his object is seed, the flowers must be allowed to develop and be fertilised by insects. There is a bumble bee in the lucerne fields at Tamworth—a large black specimen—but it is the little English bee which does the great bulk of the work. There is not likely to be any shortage of labour in this respect, as lucerne flowers provide the very best honey—equal, it is said, even to box flowers—and many lucerne-growers and others derive considerable profit from their apiaries. By watching for the bees, Mr. Laidlaw says a man may be guided in his judgment as to whether he should save his crop for seed :—

If you see no bees on the bloom, there is no moisture there. If you walk along your paddock when the lucerne is out in bloom and hear a constant hum, you may take it that you are going to get a pretty good seed crop. Sometimes you can hardly hear yourself talking in the paddock with the hum of the bees.

If you see no bees in your lucerne for a week or two after it comes into bloom, you had better cut it for hay ; it is a sign that there is no moisture and no substance in the bloom. You must have a healthy bloom for seed ; otherwise the first hot wind will blow it off, as there is no sap in it.

Judging the Seed Crop.

After the plants have come out in full bloom and been fertilised by the bees, they must develop pods. A little rain is required about this time to enable the pods to form. It is the critical stage, when the grower must concentrate his attention upon the crop The plants will be a fortnight in flower before he can really decide whether to save the crop for seed. Meanwhile the value of the hay is deteriorating every day, and the mower is kept ready to go into the field if and when the grower deems it unwise to risk getting a seed crop, and considers it better to take the inferior hay. Mr. Mathieson says :—

> An experienced man will not suffer much loss. When the plant comes into flower, if it is going to be a failure the bloom drops from the stalk without leaving any pod. That happens with a dry wind ; or even without the wind the flower will sometimes drop off, It is one of the things which we cannot always account for. It occurs in some crops. and in some seasons. As soon as you see the bloom dropping without leaving any pod, cut the crop for hay. The hay will be somewhat stalky, but it will be good hay for chaff. That is the only thing which you can do with it.
>
> We like to see the flowers all disappear at once. In some crops the lucerne will keep reflowering for weeks and weeks, on account of too prolific growth. One part is podding whilst another is flowering. Such a crop will give a very uneven sample of seed. Some of it will be ripe, some half-ripe, and some green. It is not a satisfactory crop to leave for seed.

The grower must therefore watch the crop closely from the time it flowers until it pods. If he sees the pods forming very rapidly, he knows it is safe, and that he will get a crop, or at any rate that all is going well.

The Time to Harvest.

Here, again, while some guiding principles may be stated, much must be left to the grower's own judgment. The time usually occupied in ripening is about twelve weeks from the last cutting, but it may be a week more or less.

Mr. Mathieson recommends that the lucerne should be cut when the seed is just on the green side, to produce the best grain of the brightest colour. The pod is of a very dark green colour at first, but as it is ripening it turns a deep yellow. Later it becomes brown. It should be cut when it is deep yellow. It will ripen a little after it is cut, and give the best sample of seed. When the pod is deep yellow, the grain inside is the same colour, although quite soft, and it will mature into prime seed after the crop is cut. If it is left standing too long in the paddock the colour will be spoilt, and it will darken. Buyers, whether rightly or wrongly, have a prejudice against dark-coloured seed.

When, as sometimes happens, the grain is not maturing evenly, the aim should be to harvest when the greatest quantity of prime seed may be obtained. Matured seed will shed and be lost if it is left standing and any rain falls upon it. The grain will swell and burst the pod, and when warm weather follows, the grain will shrink to its normal size, leaving the pod open, so that the seed falls out. In moist weather there is also a possibility of the matured grain, which is in the lower branches of the plant, germinating in the pod, and thus being rendered valueless. But, as stated above, a grower should not leave for seed a crop in which the flowers and pods are forming very unevenly.

The grower must rely upon his own judgment and experience in applying these principles. The difficulty is illustrated by Mr. Mathieson:—

A man once asked me to thresh a crop for him. I looked at it, and told him it was not worth threshing. He persisted in his opinion that there was seed there, so I threshed it. I threshed all day, and got hardly any seed. He then told me that, not knowing much about lucerne seed, he had taken his neighbours down the paddock as they came along, and asked their advice. One man would advise him to cut it, and another would say it was not ripe. One would say to leave it another day, or another week; another would say, cut it now. In the end the seed all dropped out, and when I threshed it for him he had very little of it left. So authorities sometimes differ in opinion.

I never care about advising a man about his crop. Others will always give different opinions, and if anything goes wrong he will blame someone. I always go through my own crop myself, and form my own opinion. When I consider it is fit to cut, down it goes.

Readers will recollect an old fable, in which an ass takes the place of the lucerne seed.

The Method of Harvesting.

The gentlemen consulted advised cutting the seed crop with the mower. The reaper and binder should not be used, as in passing over the canvas the dry pods would be knocked off, or the seed shelled out.

Mr. Laidlaw's advice is as follows:—

Cut with a mower with a swathboard, and leave the crop in the swath for about three days. Then heap it with pitchforks. Never use the rake, or you will knock off the pods. When they are dry they break easily, and you must have them dry to thresh. Leave it a day, and then cart it in and stack it. If wet weather comes along whilst it is in heaps, you must turn it over and dry it. If it gets moist in the swath no great harm may be done, but it must not lie too closely together when wet, as it will sprout, or the seed will swell and burst the pods.

Mr. Mathieson's recommendations are given below. There are some differences in detail, but the general principles are the same.

Cut with the mower first thing in the morning—of course, in dry weather. You should not cut in damp weather under any conditions. Cut early in the morning, and leave it just as it falls. If it is a very heavy crop, it is generally picked up with the pitchfork and put into heaps. If it is a light crop you could rake it early in the morning whilst it is soft, as it will not thresh out then. My experience is, that it should not be handled in the hottest part of the day, because it shells readily then. Early morning or the afternoon is the proper time.

You may put it into heaps straight after it is cut, but in that case it will require to be left longer in the paddocks. My recommendation is to cut it this morning, and pick it up to-morrow morning.

In February it may be taken in about the third day; but it must be dry. It should be so dry that it will not sweat in the stack. It will not become tough, or "come back," as we express it, but will remain in the dry condition. It may be stacked in the ordinary way with lucerne.

Threshing.

An ordinary wheat thresher may be fitted up to treat lucerne by providing it with very fine screens. Mr. Mathieson has a machine specially made for threshing lucerne and clover. It was made by a New Zealand firm, Messrs. Andrews and Bevan, who put it on the New Zealand market for threshing clover seed. The firm sent a representative over here to ascertain the requirements of the lucerne seed crop, and then made some alterations in the machines to meet the conditions. Mr. Mathieson finds the implement very satisfactory. Messrs. James Martin & Co., of Sydney, are agents for this particular machine.

Cleaning.

There is apparently no implement on the market which will thresh and clean lucerne seed. A blast winnower is taken around with the thresher, and the threshed seed is put through this, to clean it. It is then ready for market. No attempt is made to grade it. The winnower removes the broken stalks and leaves, and other foreign matter from the seed, and it is then put on the market. City seed merchants have special grading and cleaning machinery for treating lucerne seed, but Mr. Mathieson says:--

I do not think the seedsmen put the whole of it through. I have seen a lot of seed turned out here that there would be nothing to take out of, as it is as clean as it is possible to make it. Tamworth seed has a particularly good reputation for cleanliness. There is no dodder in the district to my knowledge, and there is no weed here, the seeds of which would be likely to mix with lucerne seed. The only time you are likely to get weeds is in a young crop.

There used to be dodder in Tamworth district. It came here with imported seed. It must be thirty-five years since it has been here. The growers dug it up, and carted brushwood and other combustible material, and burnt it out. They got rid of it, and there has not been a vestige of it here since. There were only a few small patches, and those paddocks have been ploughed up and planted with other crops. They have now been growing lucerne for many years without a sign of dodder.

The Yield

A 4-bushel bag to the acre is considered a fair crop; but the yield goes as high as two bags, or even more on small lots. Still, if, on a large area, a man gets a bag to the acre, it is looked upon as a very fair return. This represents about 250 lb. of seed. Even at the low price of 6d. per lb., this returns £6 5s per acre, but growers have lately been receiving 1s., or even 1s. 3d. per lb., and cases are known of from £15 to £18 per acre being obtained from seed. That, of course, implies an exceptionally good crop, and a fair price. In a good season for seed, four cuts for hay will be obtained in addition. A very moist season is not suitable for seed, and Tamworth men sometimes wish for a little more hot dry weather in summer. The figures will explain why growers are so ready to try their luck with seed crops, even if we accept Mr. Adamson's despondent reflection that, "like angels' visits, they are few and far between."

Storing.

When the seed is not placed on the market immediately, it is usually stored in air-tight iron tanks, but sometimes in double bags in a dry place. It must be kept dry, or it will be ruined. If exposed to the air, it will turn brown, which affects its market value, as buyers like it to be of a golden colour. The light seems to have as much effect as the air, as Mr. Mathieson has placed some in a bottle and sealed it up, when it went brown right through; whereas when it is kept in air-tight tanks, it retains its golden colour. The matter appears to require some investigation, particularly to ascertain whether the market prejudice against dark seed is founded upon any real deficiency in germination or other quality.

Conclusion.

It is hoped that these remarks will be sufficient to give readers a general knowledge of the principles underlying the lucerne seed industry. Without wishing to detract from the value of the output from any other districts, it may safely be said that Tamworth seed has gained an enviable reputation on the local market. A little while ago, Mr. Elwood Mead, the American Irrigation Expert, recently engaged by the Victorian Government, paid a visit to the district, and his report resulted in orders for seed coming to Tamworth from across the Murray. The growth of lucerne is rapidly extending in New South Wales, and perhaps before long the principle of acclimatisation will be carried so far that no growers will plant seed except that grown under conditions as nearly as possible similar to their own; but even that great development will not do much injury to the demand for Tamworth seed, as the beautiful Nemingha Valley is typical of our best and most prolific lucerne districts, and its produce gives excellent results wherever the legume is most extensively grown.

SEEDS FROM THE EAST.

FOR some time past Mr. J. B. Suttor, Commercial Commissioner for New South Wales in the East, has, at the request of the Minister of Agriculture, been endeavouring to obtain seeds of plants which promise to be of value in this State.

At Mr. Suttor's request, Messrs. Evans & Co., of Shanghai, forwarded seeds of Long White Turnip, Chinese Kale, Spinach, Large White Cabbage, and Long Green Cabbage, which came to hand in March last, and were distributed to the Hawkesbury Agricultural College and Experiment Farms for trial.

Later Mr. Suttor forwarded samples of Siccawei-grown seed potatoes, large and small varieties. These were quarantined in cold store. Half of them have now been planted, under quarantine, at the Hawkesbury Agricultural College, and the other half will shortly be planted at Glen Innes Experiment Farm.

Further packets of vegetable seeds—Climbing Cucumber, Radishes (2), Turnips (2), Egg-plants (2), Carrot, and Runner Bean—came to hand in June, and have been distributed to the Department's farms for trial. Another collection of seeds, comprising Kaoliang, Soya Bean, and two other beans, White Maize, Millet, Castor Seeds, Hsiao-matzu (for making oil and oil-cake), is now on the way out; and Mr. Suttor has ordered Cabbage, Radish, Turnip, Pumpkin, and Potato seeds to be sent from Central Manchuria.

All of these seeds will be tried by the Department, and if any of them show signs of being of commercial value here, seed will be raised and distributed to farmers. The acclimatised seed will be of far more value than imported seed.

Diseases of Lambs incidental to Marking.

C. J. SANDERSON, M.R.C.V.S., Government Veterinary Surgeon.

EVERY season during the period in which lambs are subjected to the above-mentioned operation, reports reach the Department of Agriculture of deaths closely following. There can be little doubt that large numbers of lambs are lost annually, and the proportion in at least one recorded case reached 8 per cent. out of a flock of 16,000. A loss of this sort is a serious matter, and when it recurs annually, as many of these losses do, the gravity of the matter is greatly increased.

Numerous theories have been advanced to account for these losses, and it would seem probable that the deaths do not occur from any one cause. As a matter of fact, they may be due to any disease which is capable of transmission by inoculation, the unhealed wounds providing the channel by which the infection reaches the lamb. The fact that deaths always cease within a short time of the healing of the operation wound, and start a short time after its infliction, strengthens this assertion.

As a rule, lambs start to die within four days from castration, but in some cases it has been found that no symptoms of illness have been shown for as long as fourteen days. This difference in the incubation period depends on what organism is the cause of the disease. For example, the tetanus organism may be in the body several weeks without the animal developing any symptoms of tetanus, while some of the forms of blood-poisoning may cause death in twenty-four hours from the time of inoculation.

Experience shows that the following inoculable diseases are the ones most likely to cause mortality amongst lambs:—Tetanus (lockjaw), malignant œdema, septicæmia (blood-poisoning), and anthrax. The lastmentioned disease is usually confined to certain well-known localities, and moreover, is not usually transmitted by inoculation. It is a possible, but not probable, cause of numerous deaths amongst lambs. An occasional death may be due to anthrax, but certainly no very great number die from this cause during the marking season. Tetanus, on the other hand, seems a far more likely cause, and the symptoms detailed by owners usually point to this disease as a cause of death.

TETANUS.

Tetanus is an infective disease caused by a specific bacillus which has a wide distribution in nature. It is contained in the soil, and in the dung of healthy horses, cattle, dogs, and rabbits. Sheep-yards are particularly favourable abodes for tetanus bacilli, owing to the soil being rich in animal manure.

The cause of the disease is the infection of wounds by dust, earth, &c., which contain the tetanus bacillus. Cutting and tailing provide the wounds for the reception of the bacillus.

The time which tetanus takes to develop after a wound becomes infected varies, but is usually a few days.

Symptoms.

The first symptom noticed in lambs is a stiffness in walking. The hind-quarters are usually affected first, but very soon afterwards the tetanic spasm extends forwards until all four legs are affected. The head is also raised and the ears cocked; but before these symptoms are noticed the lamb usually lies down, and makes no attempt to rise again.

When the animal is down, the position assumed is very characteristic. The legs are stretched out like the supports of a trestle, and the head is bent back towards the body.

It will also be noticed that the breathing is much quickened, and attempts to open the mouth will show the jaws tightly closed. The animal has a tucked-up appearance, due to the contraction of the abdominal muscles. When the lamb is handled the tetanic spasms are increased in severity, while the breathing gets much quicker. The animal remains quite conscious, and even when unable to rise may live for days.

Post-mortem.

The results of a *post-mortem* examination of a case of tetanus are usually nil. There are no characteristic anatomical changes, and the examination of the carcase of an animal dead of tetanus is of very little use, except to a trained pathologist. As an aid to diagnosis, it is useful to get any wound found in the carcase submitted to a bacteriological examination, to demonstrate the presence of the bacillus. The tetanus bacillus does not leave the wound in which it finds a lodgment, but destroys the animal attacked through the poison it manufactures there.

Treatment of this disease is impracticable. Prevention, which will be dealt with later, is the great thing to aim at.

MALIGNANT ŒDEMA.

This is another infective disease, caused by a specific bacillus. Like the tetanus bacillus, it has a wide distribution at the surface of the earth, occurring in garden earth and in cultivated soil generally. It is also a constant inhabitant of the intestines of the herbivora, and is found in their fæces. The cause of the disease is the infection of wounds by dust, earth, &c., which contain the bacillus. The sheep is readily infected. (This disease sometimes causes extensive losses at shearing time, due to the infection of cuts made while shearing.)

Deaths usually occur within forty-eight hours from time of inoculation.

Symptoms.

Generally the first intimation received by the owner is the discovery, some thirty-six to forty-eight hours after tailing, of a few dead lambs in various parts of the paddock. This experience will be repeated for three or four days, when the disease usually ceases. If noticed ill during life, lambs appear listless, and disinclined to move about. If forced to move, the hind legs are drawn forward with a peculiar stiff, dragging movement, as if there were no joints. There are slight muscular tremors all over the body, which become spasmodic as

the disease progresses. If forced to move, the lamb soon lies down exhausted. The breathing is fast, jerky in character, and finally there comes coma and death.

On *post-mortem* examination the region between the hind legs and below the tail is found to be swollen and black. Sometimes this condition extends almost as far as the forelegs, along the floor of the chest. This black appearance is due to the death of the part (gangrene). The intestines are usually healthy, but the covering of the lungs and heart is often inflamed.

Treatment of this disease is useless. Here, again, preventive measures should be adopted.

SEPTICÆMIA (Blood-Poisoning).

This term is applied to certain infectious diseases, in which the blood is invaded by micro-organisms, which multiply in it and cause disease. These micro-organisms find their entrance into the blood-stream through a wound.

Symptoms.

Lambs affected with blood-poisoning show high fever and extreme weakness, and are dull and disinclined to move. Later, complete loss of appetite and profuse diarrhœa appear, followed by coma and death. The *post-mortem* appearances are not very distinctive, the most important alterations being in the blood, which is tarry-looking and does not coagulate (clot). The alterations in the organs are only discoverable by an expert.

Treatment of this disease is useless.

PREVENTION.

Here we have a number of fatal diseases caused by different micro-organisms. For practical purposes it is less necessary to distinguish between the various diseases than to recognise that the animal acquires them all in the same way, viz., by wound infection.

In order to prevent mortality caused by tailing, &c., it is necessary to prevent this wound infection. It is certain that in most instances the contagion is present in the sheep-yards, and is consequently extremely difficult to get rid of.

The following experiment was made during a fatal outbreak, in order to establish this fact: Four wethers were inoculated with 5 c.c. of water, in which earth from the surface of the yards had been stirred. The bulk of the solid matter was allowed to precipitate, and the muddy-coloured fluid injected. This inoculation produced malignant œdema in all cases, from which two out of the four succumbed. With this proof, and the knowledge that various micro-organisms may remain alive for years in the soil, it becomes imperative to protect lambs from this source of infection.

When marking small flocks, it is best to use temporary yards made of movable hurdles, situated in a fresh paddock. With large flocks this is perhaps impracticable, and the following treatment of the yards is recommended :—

Remove the surface soil of the yards to a depth of about 6 inches, and place it in a heap, where it should be thoroughly mixed with quicklime. Then saturate the fresh surface exposed with a strong solution of non-poisonous sheep-dip.

In addition to the above precautionary measure it is essential to adopt some means of preventing the germs of disease from gaining entrance into the flesh-cuts made in the scrotum and tail. As the yards, although the main, are not the only source of infection, it is recommended that wounds of the scrotum and tail be either smeared with tar or dressed with carbolised oil (1 part of carbolic acid to 12 parts of oil) before the lamb is released after the operation. This is most important.

Knives used for docking and tailing should be boiled, and not allowed to come in contact with the ground during use. At one outbreak I was greatly puzzled to account for the deaths, the owner having apparently taken every precaution in boiling instruments, &c. It was only when I found he sharpened his knives on the boots worn by him when opening dead lambs that the cause became clear.

Lambs dead of any of these diseases, if not destroyed, form fresh centres of infection by absorption of the micro-organism by the earth. All carcases should therefore be destroyed by burning. Finally, if measures are not taken to prevent these diseases, the losses, in addition to occurring annually, will show a tendency to increase in extent by reason of the increased soil contamination.

ANOTHER DISEASE OF LAMBS.

There is another disease of lambs which, though not caused by cutting or tailing, occurs at about the same period of the animal's life, and is in a sense connected with these operations, inasmuch as tailing is found to be the best method of prevention. The disease in question attacks lambs from four to eight weeks old, and always seems to select the best, most forward, and apparently the strongest lambs for its victims. The symptoms are not very characteristic. Usually a particularly fine lamb, about a month old, is found dead, and after that deaths may be frequent, until the death-roll reaches a high percentage.

If noticed ill when alive, the affected animals will be found lying down, and in an apparently semi-conscious condition. Signs of diarrhœa are usually to be observed, and the breathing will also be quickened. If put on their feet the lambs will stagger about as if they had partially lost the use of their limbs, the hind legs especially being affected. The appetite is entirely lost. Deaths may occur suddenly, or the animal may linger on for a couple of days before succumbing. The *post-mortem* appearances are not likely to be of much service to the average layman in determining the cause of death. The principal alteration is in the kidneys, which appear to be the main seat of the disease, although the liver, and in a lesser degree the heart, may also be affected.

The kidney is found to be enlarged, very dark in appearance, and often so full of hæmorrhage that on removing the outer covering or capsule it is difficult to distinguish it from a blood-clot. It frequently breaks when attempts are made to remove it from the body for purposes of examination. The liver is also generally congested. The pericardium, or heart-sac, is frequently found to be distended with a considerable quantity of clear, gelatinous, serous fluid. The carcase of the dead lamb will be found to contain a large amount

of subcutaneous fat, and, in addition, fat will be in excess in all normal situations. Frequently the lamb shows a striking deficiency of muscle.

The cause of death is undoubtedly due to the condition of the kidneys, but some difficulty is experienced in determining the actual cause of the diseased condition. Professor Gilruth, of Melbourne Veterinary College, attributes it to inability to eliminate, as rapidly as is necessary, the urea and other poisonous substances naturally—and then excessively—present in the blood (owing to the rich and abundant diet).

The conditions almost invariably found in connection with this disease support this theory. The ewes are fat, the pasture particularly good, and the ewes' milk very rich in quality, and often excessive in quantity. Owing to the richness of the pastures, the sheep do not have to move far to obtain feed, and consequently no great amount of exercise is taken by the lamb. The milk supply, supplemented by rich herbage which the young animal has just commenced to crop, combined with the small amount of exercise taken, must produce a plethoric condition which predisposes to this disease.

Treatment.

Treatment is confined to reducing the lamb's condition by bleeding, and docking of the tail at the age of *three weeks* is recommended as a great preventive of this disease. When the lamb is seen to be ailing, no curative treatment is possible.

Cold Storage of Apples and Pears.

In April last the Manager of the Bathurst Experiment Farm forwarded one case of Winter Cole and one case of Madame Cole pears, and four cases of Esopus Spitzenberg and one case of Dougherty apples, which were placed in Messrs. Birt & Co.'s cold stores on 22nd April. On 29th August the fruit was examined by Mr. G. Bradshaw, who reported that the apples were in excellent marketing condition, there being but from four to six soft ones in each case. The pears, however, were bad, and there were only enough sound ones left to fill one case. These were promptly marketed. Mr. Bradshaw considers that the cause of decay of the pears was the large amount of handling which the fruit necessarily receives in transit from orchard to the cold store. He recommends growers attempting to hold pears or apples in cold store to arrange for a repacking in the city, every fruit showing the slightest bruise to be rejected. Otherwise the moist, mouldy matter will penetrate the whole case. As an alternative, he suggests that each case be lined on the bottom with two or three newspapers, and an equal number be placed on top of the fruit. This method has been found very effective in preventing breakage of eggs brought by rail.

The Date Palm.

W. J. ALLEN.

THE Department of Agriculture has long recognised that the improvement of the conditions of life in our western area, as well as the problem of turning those arid lands to more profitable account, require the introduction of useful and ornamental trees which flourish under similar conditions in other parts of the world. Unquestionably, one of the most suitable of these

Fig. 1.—The Date Plantation at Pera.

is the Date Palm (*Phœnix dactylifera*), indigenous to the deserts of Northern Africa, Arabia, and Persia, and extensively cultivated in the oases which occur in those regions, where its fruit is the chief source of food supply, and the main article of commerce. The Arabian proverb that "The King of the Oasis bathes his feet in water, and his head in Heaven's fire," points to the suitability of this tree for the climatic conditions prevailing in the locality of our artesian bores, where the necessary dry, hot atmosphere and soil moisture are readily available.

In January, 1892, Mr. Fred. Turner, late Government Botanist, recommended the Department to obtain from the French Government rooted suckers of the variety known as *Deglet nour* (date of the light), as seeds could not be depended upon to produce plants true to the parent.

With the approval of the Minister, the Agent-General was asked to obtain the suckers, and communicated through the proper channel with the General Governor of Algiers. "Out of gratitude to a country to which Algiers owes a great part of its vegetable acquisitions," the Government General of Algiers paid the expenses of carting 100 suckers from Bisera to the Trial Gardens of Hamma, near Algiers, and of submitting them to certain care to accelerate the formation of roots.

Fig. 2.—Tree at Pera carrying 200 lb. of Dates.

The Government of South Australia having previously asked for plants arrangements were made to divide the suckers into two lots for Sydney and Adelaide respectively; but owing to a misunderstanding on the part of the Algerian authorities, the Adelaide consignment alone was prepared and sent, and the whole process of preparing the suckers for New South Wales had to be gone through again. Fifty palms were eventually received in August, 1895, and distributed for trial, thirty-two to Pera Bore and sixteen to Wollongbar Experiment Farm

The plants sent to Wollongbar are doing well, but naturally they are not so thriving as those at Pera, where the climatic conditions are all that could be desired.

It should be mentioned that the Date Palm possesses remarkable longevity, the average life of a tree being probably 100 years; but it does not reach its fruiting stage until it is some few years old. Male and female flowers are produced on separate trees, and pollination is necessary to the formation of fruit. Natural pollination would require the rearing of equal numbers of male and female trees, whereas a male palm produces enough pollen to artificially fecundate a great number of trees; hence artificial pollination is largely practised amongst the Arabs, and it has always been practised at Pera.

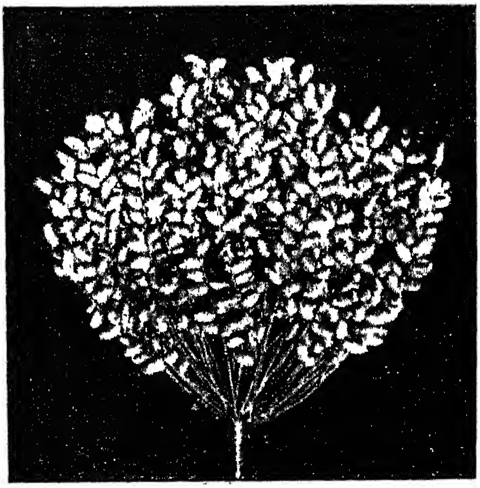


Fig. 3.—Bunch of Dates grown at Pera. Weight, 32 lb.

Several of the trees at Pera produced fruit in 1900. Though imported as *Deglet nour*, there are found to be several varieties at Pera, the fruits of which are from small to above medium size.

One plant is now carrying a very heavy crop, having upwards of 200 lb. of uncured dates on it. The fruit is not as large as the bulk of the imported fruit, but compares very favourably in flavour.

There are many other female Date Palms which bloom and set their fruit, but the latter dries up in place of developing properly at the time it should ripen. I am quite satisfied that if we had some of the best and largest varieties of dates, and these were properly looked after, they would yield heavy crops of fruit after they had once attained a fair age.

Sheep-maggot Fly in the West

WALTER W. FROGGATT, F.L.S., Government Entomologist.

In compliance with a communication from the Secretary of the Farmers and Settlers' Association of Trangie, and another from the Secretary of the Pastoral and Agricultural Association of Nyngan, I was instructed to visit the former district and investigate this matter.

Acting on these instructions, I visited Trangie at the beginning of July and spent several days in the district with some of the sheep-breeders, to find out the extent of the damage. On Saturday afternoon, 2nd July, I attended a meeting of the Trangie Association, and addressed the members on the sheep-maggot fly, obtaining a great deal of information from them.

They had previously passed a resolution at their last meeting (June 4th) "That this Association desires to draw the attention of the Government to the fly pest in sheep, which is causing such loss to the State, and that action should be taken to find a preventive by offering a reward or otherwise."

A similar resolution has also been passed by the Pastoral Association at Nyngan and forwarded to the Minister of Agriculture.

I pointed out to the members that during the last six years a great many mixtures, dips, and powders had been in use in all parts of the State, with more or less success as lasting cures, to keep the flies from blowing the wool or reinfesting the previously blown wool. The active properties of most of these are crude oils, turpentine, tar, carbolic acid in various forms, and arsenic. Many of these rubbed in after the damaged wool has been shorn off, will drive the flies away for a time, but none has been found that will last for any length of time. The reason is that the wool is always growing, and in a few weeks or a month or two there is a layer of new untreated wool below the poison (if it still remains), which, if it becomes damp or soiled, will be a safe feeding place for fresh maggots. It is therefore very difficult to find any dressing that can be lasting, on close-woolled sheep, particularly when full fleeced, for some months before shearing.

Our investigations show that the damage is caused by the maggots of the two common yellow blowflies (*Calliphora villosa* and *C. oceaniae*), found in both the house and the bush all the year round. In winter they deposit eggs upon everything they infest, but in summer the eggs are hatched in the body of the fly and living maggots dropped. In no case have I found any species of the bright green or blue metallic flies, so common about dead sheep, to breed out from maggots taken from blown wool from the backs of live sheep. The destruction of all material in which these blowflies deposit their eggs or maggots will be the greatest factor in reducing the sheep-maggot fly pest.

Through not taking into consideration the development of the blowflies, the farmers and settlers, when dressing the sheep, throw down the damaged wool, and scrape the maggots out of the wounds. The maggots fall to the

ground, and if nearly full grown, burrow into the soil and rapidly change into pupæ. The previously soft white maggot is then encased in a stiff parchment-like shell, where it can remain safe and sound until suitable conditions arise, when the enclosed blowfly, which has developed from the maggot, inside the pupal shell, bursts out of its protective covering, and emerges a new-born blowfly. In summer, this transformation from maggot to pupa, and pupa to blowfly, is only a matter of days; in winter it is often a matter of months. Now, allowing that the sexes are equal, every other blowfly maggot that escapes from the blown wool is capable of reproducing a female blowfly that can deposit 100 eggs (a very low estimate, for it is often double that number) several times in the course of her life of a few weeks.

Thus every well-developed maggot that the dresser allows to get under cover means another fly. Even if the poisonous dressing fluid fall upon the maggots, or is sprinkled over them, as is often the case, if they can get away from it into the soil they soon work it all off their skins, and suffer no damage that will stop them from developing later.

The maggots and infested wool from every blown sheep should be carefully collected and destroyed. It is quite practical. Each man could have a sheet upon which he could place the sheep being dressed, and everything could be kept off the ground and transferred to a bag, the contents being shaken out into a fire or tub of boiling water.

Under present conditions every man is reinfesting his sheep yards and paddocks every time he dresses a sheep.

The next question is the destruction of all dead animals on the runs in which the flies can deposit their maggots. Let any one go over the paddocks in the west, and examine the dead remains of sheep, cattle, or horses (not counting the poisoned rabbits in the burrows, or scattered all round the sand hills, for you are always told that "the flies cannot breed in rabbits, because there are plenty of blown sheep in places where there are no rabbits"), and they will be surprised at the results. I found maggots in everything examined—not all blowfly maggots, because there are half-a-dozen different species of flies that feed and develop in animal remains. In one case, however, I investigated a dead bullock that was said to have been burnt. The crows showed me the road to it, and though after the skin had been removed a fire had been made over the carcase, only about half had been burnt, and the paunch remained intact. Opening this out with a pole, I found it a mass of squirming blowfly maggots. There were hundreds of thousands of these almost full-grown maggots, protected from the insectivorous birds or other enemies by the dried skin of the stomach. There were enough maggots developing in this carcase to infest every sheep on the station.

If attention were paid to the destruction of all such matter by the settler, it would repay him for the trouble. "Prevention is better than cure," and surely it would be better to spend a few days cleaning up offal than be dressing sheep and losing pounds of wool, sheep, and lambs for nine months in the year.

I want to be practical, and therefore will not go into the question of destroying the adult blowflies by traps, but experiments have shown in other countries that certain strong-smelling oils have an attraction for different kinds of flies, which fly into them, and, wetting their wings, become helpless and die.

A Russian naturalist, Professor Cholodkowsky, found that the biting horse-flies (*Tabanidæ*) were quickly attracted to kerosene oil, when forming a coating on a pond in the park at St. Petersburg; and by treating all the patches of water in the adjoining forest, he cleared out all the March flies, which, flying down, were killed in the oil.

The sheep-maggot fly is said to have been very much worse this season than in previous years, and is extending into the flocks of Southern Queensland. The damage caused by these flies in loss of wool, and the death of sheep and lambs, must run into a good many thousand pounds.

I should be glad to obtain samples of blown wool from infested sheep containing well-developed maggots from all parts of the State. They could be packed in a tin and forwarded by post.

In Miscellaneous Publication No. 809, reprinted from the *Agricultural Gazette* for January, 1905, an account is given of the habits of these flies. Copies will be sent free to those interested, on application to the Under Secretary, Department of Agriculture, Sydney.

NOTE.—Since this report was published in the newspapers, many letters have appeared in the Press regarding the identity of the flies in question.

Mr. W. Munro, owner of Boombah and other Queensland sheep and cattle stations, is of opinion that the Government Entomologist's view as to the identity of the sheep fly with the common yellow blowfly found in the house and bush all the year round is incorrect. With a view to further investigations being made, the Minister of Agriculture will be glad if any squatter or other person interested in the identity of the sheep-maggot fly will forward to the Entomological Branch of the Department, packed in a tin, samples of blown wool containing well-developed maggots taken direct from the live sheep when they are dressing them. The Government Entomologist will then breed out the flies from such maggots, and prove the identity of the species in question.

The *Luciliæ*, or bluebottle flies, may blow the live wool as well as the *Calliphoræ* or true blowflies, but in every case where the Entomologist has bred flies from blown wool that he has taken on living maggoty sheep they have been the true *Calliphoræ* or blowflies. It is not true that bluebottle flies are the pest because they are seen about the dead sheep, fresh flayed skins, or dead wool. If in some districts the bluebottles do blow live wool, so much more reason that the squatter should destroy all dead sheep and offal, as the Entomologist finds great masses of the pupæ in the bodies of every dead sheep examined, and has now bred out 176 common blowflies from one lot of wool taken from a live sheep's back at Trangie.

Wood Lice Damaging Crops.

In the early part of August, Mr. F. J. Thornton, of "Riverview," Warren, submitted specimens of insects, which had caused considerable damage to his crop, to the Department of Agriculture for identification, and these, upon examination, were found to be "Wood Lice."

This was not the first occasion that these insects had been brought under the notice of the Department, as Mr. A. R. Samuels, Acting District Forester at Narrabri, had previously sent specimens which had been collected in an open plain, about 2 miles west of Pilliga, where they were stated to have been in millions, all travelling in the one direction—due west.

As the pest was reported to be damaging growing crops, Mr. W. W. Froggatt, Government Entomologist, visited Warren on the 16th August, for the purpose of investigation. On arrival there, he was accompanied by Mr. Thompson, a local resident, to the paddock of Mr. George, who had lost about half his crop, sown for hay, through the agency of the wood lice. Mr. Froggatt found the damp soil on the edge of the vegetable garden swarming with the insects; and in the adjacent paddock, large patches of the young wheat had been eaten clean out. Even the tufts that had shot out had all the lower leaflets frayed and nibbled by the lice, which were then buried in cracks in the soil, the latter appearing as if it had been raked over, caused, Mr. George stated, by the feet of the countless thousands of insects swarming over it. However, the pest had then passed its worst stage, and it is expected will not do much more damage this season.

Wood lice are not true insects, but belong to the terrestrial isopods, *Crustacea*, placed in the sub-order *Oniscoida*. There are a number of different groups of them, classified according to the structure and number of joints in the antennæ.

In their native state they feed at night upon decaying wood and vegetable matter, hiding during the daytime under logs and wood. They prefer damp situations, and are common on the plains under cow-dung, bits of wood, and such material. Warm, damp winters seem to be favourable to their multiplication. They have been very abundant and destructive in suburban gardens about Sydney during the last season, but a little Paris Green sprinkled about the seed boxes will generally drive them away. However, the removal of all likely places where they may seek shelter will greatly reduce their numbers.

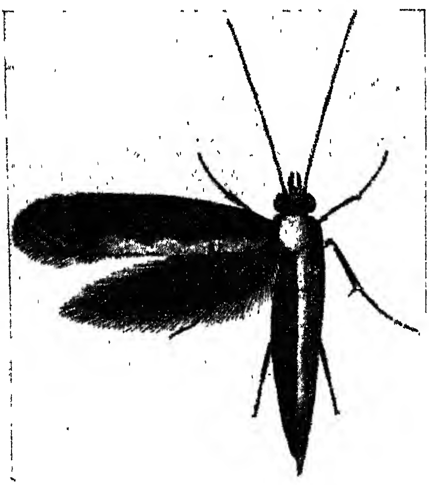
In a cultivation paddock, the most simple method of dealing with them would be to roll the paddock with a heavy roller; or, in an open plain, a flock of sheep run over them would keep them in check, as the slightest injury kills them.

The principal factor in the increase of such pests as cut-worms, wood lice, &c., has been the destruction of our ground hunting birds. The magpie is an example of this. By nature, he is inquisitive, hunting over the plains, turning over every bit of rubbish, and picking out the insects thus exposed. This bird has suffered greatly from the effects of the laying of poison for rabbits, as he will readily eat the poisoned pollard, and even the poisoned rabbit.

The Diamond-backed Cabbage Moth

(*Plutella cruciferarum*, Zeller).

WALTER W. FROGGATT, F.L.S., Government Entomologist.



Diamond-backed Cabbage Moth, viewed from above. (Enlarged.)

UNDER the name of the "cabbage grub" or "cabbage worm," the caterpillar of this little moth, once a European turnip pest, but now world-wide in its range, is well known to Australian cabbage-growers, and also to the cabbage consumer when he finds the little green worms among the leaves of this useful vegetable. It has been known from a very early date among the English farmers, where it is more a turnip pest; but it attacks both turnips and cabbages when grown under the same conditions.

Under the name of *Cerostoma xylosteum*, "The Turnip Diamond-back Moth," Curtis in his "Farm Insects" says:—

> On the Continent it lives principally upon the upright honeysuckle (*Lonicera xylosteum*), and attacks a great number of culinary plants, but seems to prefer the cabbage and the turnip.

The Pest in Australia.

It was probably introduced into Australia from England, though it may have come *via* Mauritius, where it was a well-known pest, and with which island there was a good deal of direct trade in early days. It was identified by Mr. Meyrick from descriptions furnished in 1883 by the late Sir William Macleay, who stated that it was common in many parts of Australia, and had been for some years previously, particularly about Adelaide. It feeds upon all kinds of plants belonging to the family *Cruciferæ*, such as the turnip, cabbage, cauliflower, mustard, cress, and charlock and a number of similar weeds often found about neglected gardens.

Tryon, in his "Report on Insect and Fungus Pests" (published by the Queensland Department of Agriculture in 1889), gives an interesting account of the cabbage moth and its spread in the market gardens in Queensland

under the popular name of the "Small Cabbage Worm." From the information he gleaned from the cabbage-growers of Toowoomba he considered that at that time, though well established, it was a recent introduction, having been recognised as a pest only about five years previously. He was the first in Australia to suggest that the boiling-water remedy, as used in the United States for the destruction of the larger caterpillars of the cabbage butterfly, might be as effective upon the tiny cabbage-moth grubs, and he quoted from the Report of the Entomologist of the United States, Department of Agriculture, 1883.

In 1893 French gave an account, illustrated with a coloured plate, of the Diamond-backed Cabbage Moth, in the second part of his "Destructive Insects of Victoria." He deals with the range of the pest and the damage it does to garden crops, quotes from most of the authors who have written upon the subject, and suggests a number of remedies that have been used with more or less successful results in Victoria and elsewhere.

Under the heading "Insect Pests," Fuller published a history of the "Small Cabbage Moth" in this *Gazette*, Vol. VII, 1896, illustrated with two plates. In dealing with remedies he repeats the greater part of Messrs. Tryon and French's suggestions.

In Other Countries.

In England, though the Diamond-backed Moth is at times a serious pest to the turnip fields, it comes and goes. Miss Ormerod believed that swarms of moths were often wind-blown across from the Continent, and thus infested the eastern coast of Britain. This little moth must not be confounded with the insect that is more commonly called the "Cabbage Moth" in England. This is one of the cutworms (*Mamestra brassicæ*, Linn.), which lays her eggs upon the cabbage plants.

In the United States the Diamond-backed Cabbage Moth is not a very serious pest, and though there are a great number of references to it in "Insect Life," there are only three brief notes on its occurrence in the States. Its place, however, is taken by the white butterfly (*Pieris rapæ*, Linn.), which swarms over the gardens and deposits her eggs upon the plants, the caterpillars soon devouring all the leaves if the plants are neglected, and no preventive measures adopted. These butterflies were swarming in thousands over the market gardens in the vicinity of San Francisco when the writer was there, towards the end of the summer of 1908. In England this butterfly is known to collectors as the "Large White," and is the commonest butterfly in the country. Spraying with arsenites is the chief method adopted in America to destroy these insects.

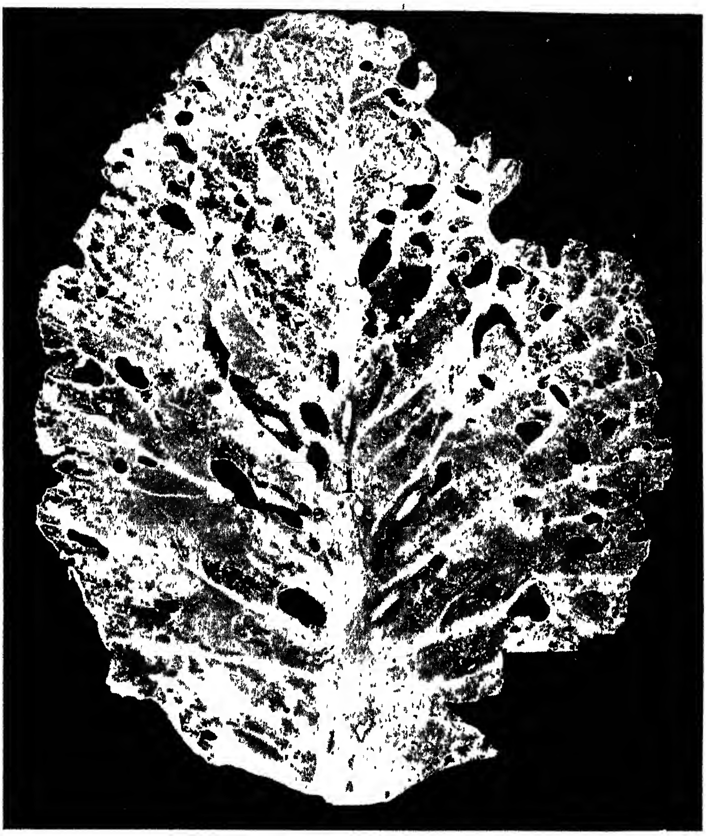
In Canada, Fletcher records the Diamond-backed Moth as a serious pest at times in the North-West. Miss Ormerod states that in the eastern provinces of Cape Colony it does much damage to the turnip fields.

Life-history.

The life-history of the Diamond-backed Cabbage Moth is so well known that it need only be briefly outlined in these pages. The moth, on the wing among the herbage, appears to be of a uniform brown tint, and does not show the distinct angular row of pale markings along the upper margins of the folded wings from which it takes its popular name, "diamond-backed," and by which it can be so easily identified among pinned specimens from all other allied species. It measures slightly over half an inch across the outspread wings. Emerging from the stout chrysalid skins, which, attached to bits of cabbage leaves, stalks, or weeds, have protected them, under shelter of their flimsy cocoons, through the winter months, these active little moths lay their eggs upon the foliage of the young cabbage plants, and remain in hiding among the weeds and on the under side of the cabbage leaves. As soon as the fine weather sets in, if one walks through a cabbage patch, and sees numbers of small brown moths rising up before him, he will, even if the plants have not begun to show its effects, know that the cabbage moth is about. If he investigates the plants, he will find the leaves marked with glassy spots where the tiny, black-headed, pale green caterpillars have been at work. So like the surface of the leaf are these caterpillars in coloration that they would be easily passed over, if it were not for their gnawing off the epidermis of the leaf.

As they increase in size, they become slender, bright green caterpillars (popularly known as "cabbage worms"), resting upon the surface of the leaves and gnawing holes right through them. At first confining their attention to the larger outer leaves, as they increase in numbers they gnaw all through the cabbage, and if they are allowed to reach this stage the cabbages and cauliflowers are soon of no marketable value. The caterpillars are active little creatures, and if touched they roll away or drop from the leaf to the ground, often hanging suspended on a silken thread, and thus they escape their many enemies. When full grown, they betake themselves to the shelter of the under side of the leaf upon which they have been feeding, and spin a lattice-like, elongate, oval cocoon, or rather hammock of silken strands, securely attached to the leaf, but open at both ends. It is such a flimsy, delicate structure that one can observe the transformations of the insect. At first a green pupa, it changes to dull brown, and finally reveals all the delicate outlines of the coming moth, enclosed in the pupal skin.

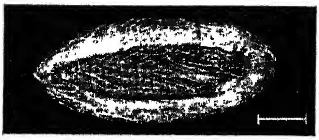
To the grower, the length of time occupied in the development of the moth from the egg, unlike that of the codling moth, is not of much economic importance in Australia, because we have almost a continuous brood of these moths and their caterpillars, cabbages being grown in many districts all the year round. Though economic entomologists have carried out many observations on the time taken on their development, the results have been very variable. In England the caterpillars are said to feed for nearly a month, and the pupæ remained in the chrysalid state from ten to seventeen days. In Australia, in the early summer, the eggs in suitable situations will hatch within a couple of days; the caterpillar state does not last over a



Leaf of Cabbage showing damage caused by caterpillars of Cabbage Moth, with larvæ and cocoons on the leaf. [Reduced.]

Caterpillar. [Enlarged.]

Pupa (chrysolid) removed from cocoon. [Enlarged.]



Cocoon enclosing the pupa. [Enlarged.]

Cabbage Moth, side view. [Enlarged.]

fortnight; and the pupal state a week; but all this is regulated by the climatic conditions, warmth and cold accelerating or retarding their development, as with other insects.

Some Natural Checks.

It might be here noted that while cold and even frost have little or no effect in destroying insect life, yet heavy continuous rain and wind storms do an immense amount of good by destroying insect pests, particularly those that infest field crops exposed to the fury of the storms and rain.

Such insects as the Diamond-backed Cabbage Moth form a large portion of the food of our small field birds, such as robins, flycatchers, wrens, white-eyes, ground larks, wood swallows, and many others; which birds, when the younger generation have learnt to appreciate them for the good they do in destroying pests if not for their beauty, will be just as carefully protected from harm as they are now carelessly destroyed.

How the Pest is Spread.

Our cabbage and cauliflower growers in many districts, with few breaks, grow these vegetables all through the year, the young plants being often set out alongside those ready for cutting, or upon the abandoned patches from which the marketable vegetables have been cut; for there is no real winter in many parts of the State. Thus, with a continuous crop, the cabbage moth can breed all the year round, even if there are no cruciferous weeds growing in the gardens, such as wild charlock or mustard weed, upon which they flourish. This is one of the reasons why the cabbage moth is such a serious pest in New South Wales.

Many of our growers are not careful enough in seeing that the young cabbage plants which they buy in bundles from dealers, or from each other, are perfectly free of moth grubs. Anyone going around the Sydney shops (when, as at this time of the year, the suburban resident is busy planting his kitchen garden, and there is a brisk demand for cabbage plants) will see plants for sale with leaves riddled with holes caused by the cabbage moth, and with grubs and eggs still upon them. Yet the ordinary man takes these home, and plants them out without any precautions, such as dipping them in tobacco and soap wash or other mixture; and then later on he will wonder why they are grubby.

The regular market gardeners, or farmers and orchardists who combine both industries, either grow their own plants in seed-beds, or buy them from the Chinamen (when they will sell them); but I have seen them, in the white man's seed-bed as well as in the Chinese garden, badly infested with moth grubs. Unless the young growing plants in the seed-bed are treated until the time of planting out, they soon attract the moths from old cabbage patches. If all cabbage plants were carefully clipped and washed before they were planted out, they would have a fair start in life, without any aphis, cabbage moth, or other pests infesting them.

Then again, our cabbage and cauliflowers are grown in open fields, like the turnips on English farms; and as soon as the cabbages are ready, all the marketable ones are cut and bagged; while all the unsaleable ones are left on the ground, to rot or run to seed, and remain until the owner wants the ground for something else, which may not be for months. This neglected plot is the breeding-ground for the cabbage moth and all other cabbage diseases, insect and fungus.

During his recent investigations the writer often saw a fresh bed of cabbages planted out right alongside such an abandoned patch; yet the owner could not see why such young cabbages were stunted and diseased, but blamed the weather. Often, when such a bed of cabbages becomes stunted, and aphis or grub stricken, either from this cause or from want of water and nourishment, which naturally predisposes them to all kinds of insect and fungus diseases, they are allowed to remain and linger on till the following year.

An acre of land will produce from nine to ten thousand cabbages, and under the ordinary cultivation as carried out in the Maitland district, I am informed that a third of these are waste or unsaleable. Taking the total as 9,000 cabbages, two-thirds of these, or 6,000, mean 500 dozen, which, I am told, will pay at 1s. 6d. per dozen, while they average 1s. 10d. per dozen, taking one year with another; and the crop takes fourteen weeks to mature. Cauliflowers, though more uncertain and difficult to grow, are a much more valuable crop. The Gosford growers consider that in ordinary seasons the waste is very much under a third in any vegetable garden that is looked after, about 2,000 out of 10,000 being their estimate. On land with light soil and good rainfall, handy to Sydney markets, such as we have in thousands of acres in the Gosford district, market-gardening ought to pay well; especially as we find that the Victorian growers can ship cabbages and cauliflowers from Melbourne, and, after paying all the carriage and transhipment charges, make a profit.

Remedies and Preventives.

There have been no lack of remedies suggested and advocated by the different writers upon the cabbage moth; but the greater number, though more or less successsul in a small garden, are not practicable when dealing with market gardens or farmers' crops.

Boiling Water.—There is no question that the application of boiling water will kill all the grubs with which it comes in contact, without doing any serious damage to healthy plants. It is applied with a watering-can with a fine rose, the operator walking down between the rows and giving each infested cabbage or cauliflower a good sprinkle. This is very handy for a small garden patch, but in a large field the difficulty is to keep a large quantity of water at the proper temperature, and to distribute it over a large area.

Kerosene Emulsion.—In the United States, the cabbage-growers chiefly depend on kerosene emulsion, and keep the young plants clean until they begin to heart, when they consider the danger is over. This preventive is

also used in this State. A large grower, an up-to-date Chinese gardener, told me that he used nothing else on his cabbages, and that where the moth was plentiful he gave them regular sprayings until the plants got ahead of the pest. The spray can be made much weaker for cabbage moth than for scale insects, and the grower will soon find the minimum quantity of oil and soap which will kill the grubs. The main thing is to mix the soap and oil well with the water.

Dry Spraying Lime and Tobacco Dust.—This is a very effective remedy, used by a large number of the Gosford market-gardeners, and first used by Mr. W. C. Dening, of Erina, who is one of the largest growers in the district. I am indebted to his son, Mr. G. Dening, for the following information :—

It consists of one kerosene-tinful of tobacco dust with four tins of fresh-slacked lime, thoroughly mixed and applied as a dust.. He uses it as soon as the cabbages are well established, and says he can dust 1,000 cabbages in an hour, but it must be used while the leaves are wet with the dew. Four tins of tobacco dust, and sixteen tins of lime, will dust 8,000 cabbages. This mixture remains about the plants for a long time after the application, and is death to all insects that feed upon the surface of the leaves.

Conclusion.

As before noted, the main thing is to start with clean cabbage plants in clean ground, and keep the ground clean ; and after the crop is marketed clean up the cabbage patch. Then, whatever remedies one uses will have their full effect upon the pest, and the reinfestation will be less. If, on the other hand, the land all round the cabbages is full of infested material and weeds, the grower will have to be going all the time, or he will lose a large percentage of the crop.

The Valonia Oak.

(A Tree of the greatest importance to Tanners.)

In the *Gazette* for July, 1899, appeared an illustrated article with the above title. Some information was given in regard to this particular oak, and a list of localities to which I had forwarded acorns was published. Year by year since then I have received small quantities of Valonia acorns, chiefly from Victoria, and have distributed them. I shall be glad to be informed, with the view to publishing a note in the *Gazette,* what results my correspondents have had with this useful tree. If the result in any case has been a failure or a partial failure, correspondents should not omit to state that, as the records of failures may be as valuable as those of successes.—J. H. Maiden.

Faults in the Manufacture of Butter.

CRITICISMS ON BUTTER GRADED, SEASON 1908-1909.*

GEORGE S. STENING.

IN introducing my subject, I would point out that I intend dealing with it in a general and practical way, taking the faults in order of their importance as affecting the value of the product, and under the respective heads, and in the order in which a butter is graded, namely: (1) Flavour; (2) Texture; and (3) Condition.

(1) Flavour.

The faults under this head are practically the whole of those that butter is heir to, the principal, however, being fishiness, rancidity, sourness, tallowiness, and uncleanness.

1. *Fishiness.*—This term could equally as well be spelt "filthiness," for not only is the flavour filthy and repugnant, but the direct cause is filthy contamination, which produces an infection into either the milk or cream of certain organisms, which by their action produce the above flavour. Although this is undoubtedly the worst of all flavours, still, outside the efforts of our State dairy expert, we have but scant scientific data as to the organisms responsible for this flavour and their action. However, the consensus of opinion is that the organisms responsible set up a chemical action (most probably acting on the fatty acids), producing trimethylamine, a chemical having an aroma and flavour of fish-oil.

Mr. O'Callaghan has isolated a mould (*Oidium lactis*) which he claims is the organism responsible for the production of this flavour, and although there is a diversity of opinion as to its being the correct one, it is very significant that at least it plays a very active part—firstly, because in all the distinctly fishy butters submitted to a bacteriological examination, cultures of this mould were always prevalent, and generally in superabundance of all others, excepting, perhaps, the cultures of *B. acidi lactici*; and secondly, because this infection is traceable always to dirty dairy or factory premises where the mould is allowed to grow undisturbed on the ceilings, walls, &c., and where it propagates to such an extent that the air becomes practically loaded with the conidia, or spores, which find their way into the utensils, milk, or cream, &c., and it is from such sources that fishiness is generally found. Another very significant feature, as showing the probability of this organism playing at least some part in the development of this flavour, is its strong resistance to cold. Experiments have been carried out in the direction of finding a temperature at which this "fishy" development would be checked, but although the butter was stored at various temperatures down to 5

* Read before the Co-operative Dairy Factory Managers and Secretaries' Association, Conference, June, 1909.

degrees Fahrenheit, or 27 degrees below freezing point, still the development has gone on, and although not quite so pronounced as in similar butter stored at 10 degrees, or 15 degrees, yet the flavour was unmistakably "fishy."

Again, on the other hand, this organism does not withstand high temperatures, for it has been found that 157 degrees Fahrenheit will destroy it. Experiments to prove this have been carried out, as follow:—A quantity of cream was divided—one part treated in its natural condition; the other was pasteurized and ripened with pure cultures of *B. acidi lactici*. Plate cultures revealed the presence of *Oidium lactis* in large quantities in the unpasteurized cream, whereas in the pasteurized none were present. The result of the product was that "fishiness" developed in the unpasteurized soon after manufacture, whereas the pasteurized retained its delicate flavour for some time afterwards.

Often is it the case that a factory manager uses every care and vigilance in the grading of his cream, allowing only fresh cream to enter his vat for first-grade manufacture, and what disappointment is his when on the return of the grade-note, the remarks read either "fishy" or "fishy tendency!" This may be a case of the infection of fresh cream, and it is here that the factory man meets his "Waterloo;" for no matter how careful and painstaking he may be, it is impossible for anyone to say in what manner a fresh cream is infected by tasting it in this fresh and sweet condition. Plate cultures alone can accurately determine the manner of infection; but this is beyond the factory man, at the present time at all events, to accomplish. The only way available, to my mind, is by keeping the samples taken for testing purposes under perfect sanitary conditions, and at a suitable incubation temperature, say, from 80 degrees to 90 degrees Fahrenheit, and tasting the samples in twenty-four hours. Under such conditions any hidden infection or undesirable flavours should manifest themselves, and the factory man, made acquainted that something is wrong with a supplier's cream, could visit the supplier and set things right. This custom of *checking* the grading of cream should be done periodically, for at the present time there is no more practical, simple, and effective way of determining the value or grade of cream, especially so when the manager is at a loss to understand any deterioration in quality from the time the butter leaves the factory until it passes through the grader's hands.

2. *Rancidity*.—Of the butters graded this year, many were "rancid," or, as often stated, "stale." Conn has found that rancidity is due to the complicated action of several micro-organisms, the one most responsible being *B. fluorescens liquefaciens*, prevalent in air and water. It may be of interest to know that rancidity works from the outside of a butter to the centre, thereby proving that the trouble is due in part to bacteria which grow near the surface, and which require oxygen for their development. The water used in the washing of butter is, I think, the chief source of infection, which emphasises the importance of every factory manager having the water used for this purpose periodically examined bacteriologically, not once in a year, but more often, as this bacteria, like all others, is more prevalent at certain periods of the year.

Stale, *thickly separated cream*, kept under the influence of light and air, without regard for temperature, is the more general cause of this flavour, as found in our butters.

3. *Sourness.*—This flavour was very prevalent this year, and was very often associated with "fishiness." "Sourness," as it is understood, is caused by the fermentation of thinly-separated cream, and not by "food taints."

It is a fermentation which in my opinion differs from and supersedes lactic fermentation, and is probably a form of alcoholic fermentation produced by a type of lactic acid bacteria or a yeast, and which in turn produces an acid other than lactic acid, probably acetic acid, on account of its pungent aroma, and sometimes flavour. I have found, whilst engaged on instructional work in some factories, that many factory men fail to discriminate between a true "lactic sour" and the "sour" produced by this class of fermentation. Practice alone in cream grading can explain the real difference; but it should be borne in mind that this "sour" is always only produced in the fermentation of thinly-separated cream.

The thinner the cream, say under 15 per cent. reading on the flask, or 30 per cent. butter fat, the more susceptible and quicker will be this fermentation. The only remedy for this evil at the disposal of the factory is to never mix thin cream, no matter in what condition it is received, with thicker cream, but rather to churn it separately.

I think we could copy Queensland with advantage by legislating as to the minimum fat content of a cream.

4. *Talloiciness.*—This flavour was generally found in butters from parts of the State inland from the coast. It is caused, in my opinion, by the over-maturing of cream, under conditions which tend to the infection of a certain class of organisms, which have the effect of liberating some of the volatile oils, thereby rendering the butter lardy or tallowy. Some butters that have been stored for some time, and then defrozen, assume a tallowy flavour.

The action of direct sunlight also has been stated to produce this flavour.

5. *Uncleanness.*—By this term is meant a flavour that is foreign, and not a clean butter flavour. It is caused by the absorption by the milk or cream of some foul odour from a dirty source, such as cloths used in the washing of utensils, or placed round the lids of cans whilst delivering the cream to the factory.

Bad smells from insanitary places is a common cause.

Although this flavour is not to be regarded as so injurious as the foregoing, still, many butters have suffered through its effects. When, however, it was associated with some other of the unfriendly flavours, as was very often the case, the butters were reduced considerably in flavour points.

Summarised, all ill flavours point to some diversion from correct methods of treatment, and can, in the great majority of instances, be laid at the door of the supplier. Uncleanly conditions, which create an unfriendly infection in the milk or cream, are the greatest factor to this end. This infection produces the various flavours, according to the type and action of the organisms.

The remedy, therefore, is not far to seek. Cleanliness, in its truest conception, should be observed and practised in every detail, not only in the factory, but on the farm. And here I would point out much can be done by force of example, by the manager keeping his factory and environs in every particular the pattern of cleanliness and order. It is just as inexcusable for a factory to be in an uncleanly condition as for a supplier's dairy premises, and more so, because a dirty factory can very soon undo the good work of many clean suppliers, in the manner before described.

(2) Texture.

The faults under this head are attributable to other than bacterial causes, being due to errors in manufacture, for which the factory man is wholly responsible. Seeing, therefore, the great importance of this factor on the after life of a butter and on its carrying capabilities, I think the purposes of this paper would be best attained by a somewhat comprehensive elucidation of the serious evils existing, as a means toward remedying, if possible, the results that assuredly occur from imperfect texture. During my visits to some factories I have found in a great number of instances most imperfect and primitive methods adopted in the manufacturing processes.

Why is it that just recently we heard of the serious effects caused by "heating" of some of our butters on the London market? I think I am correct in stating that, in every instance reported to us from London, the initial trouble was "want of body"—texture—in the butters. How can it be expected that a butter which is open, loose, and coarse, showing moisture, could withstand any degree of heat for any length of time without "running?" Yet these are the class of butters reported on as "heated," and which were graded as "heated" here, prior to export. The above points to some error during the manufacturing processes, such as high temperatures in churning, or of the wash water, churning the grain too large before washing down, irregular grain, or in the methods of working.

The moisture content is the controlling influence of the texture of a butter, and the texture the predominant factor of the keeping and carrying qualities. Hence it will be seen that the after life of a butter is dependent to a great extent upon the percentage of moisture it contains.

What percentage is most advantageous is difficult to assume, but this can be stated on authority, that a butter having a percentage below 14 per cent. will have a better body or texture, and will keep its flavour better, than a butter above this amount; and it would seem that the truly vital percentage is about 16 per cent., as this is the maximum amount allowed by all dairying countries throughout the world, and any amount in excess of 16 per cent. is treated as an adulteration.

High Churning Temperatures.—By high churning temperatures, I do not mean such an extreme as has the effect of producing an oily, sloppy butter, but rather such temperatures as prevent the butter maintaining a distinctly firm, granular form, producing on the other hand, a butter that has no true granular form, and which when worked easily becomes greasy.

By experience I have found the temperatures most effectual, for our climatic conditions, for producing the desirable "texture," to be: For summer, 50 degrees to 52 degrees Fahrenheit; and for winter, 54 degrees to 56 degrees Fahrenheit.

The lower temperatures I would recommend for open churns, and the higher temperatures for closed churns for each season.

These temperatures are for cream with an average density of about 30 per cent. and over, and when the cream is under the above density the temperatures should be slightly increased, say by 2 degrees all round.

The effect of too cold a temperature with thinly separated cream is to produce a butter with "shotty" grain, which is not desirable, for not only do you get a short, grainy texture, but if the greatest care is not exercised in the working, "mottle" is sure to result.

The wash water should be about 2 degrees cooler than the cream at the time of churning, on account of the rise in temperature during the process of from 5 degrees to 7 degrees in the case of open churns, and from 2 degrees to 4 degrees in the closed churns.

The cooler water, therefore, helps to keep the temperature nearly constant, and places the butter on the worker in such a condition that the working has no harmful effect on the "texture." Many factory managers will, I know, aver that these temperatures are too low, and that, if adopted, the processes of manufacture will be very much prolonged. Perhaps the operations would be extended in time, though to no alarming extent, but the result would more than compensate for any excess of time. The maxim, "A thing worth doing is worth doing well," could be very well applied here, on account of the unsatisfactory results accruing by its non-observance.

In making this statement, I do so conditionally that all the processes leading up to the churning have been correctly administered, viz., that the cream has been perfectly blended and properly ripened. The ripening of cream causes much trouble in the winter time, and owing to it, and not altogether to temperature, is the churning prolonged. This will continue so until such time as the artificial ripening of cream becomes more general, and I feel sure if managers only realised the results obtained by adopting such a system (and more especially in the winter, when ripening is as difficult to achieve, as it is to retard in the summer), many more would practise it.

Uncontrolled temperature is responsible for more inferior butter than any other single factor in the manufacture.

High temperature in churning plays the initial part in impairing "texture," and, I regret to state, is adopted by many of our factory men so as to accomplish the manufacture in a minimum of time. By such a system the butter breaks earlier and gathers more quickly than with the cooler temperatures as suggested. Then, again, after working the butter, it is in such a condition as to require little or no ramming into the boxes. But, as pointed out, this is done at the expense of "texture"—the potent factor governing the after life of a butter.

The two principal effects of a high churning temperature are:—

1. To increase the moisture content. The reason for this is obvious, viz., that the granules, instead of having a separate and distinct form, have, on account of the high temperature, their coverings so easily ruptured that they mass together, locking up the moisture in such a way as to render it almost impossible to extract it. A low wash-water reduces to a certain degree the moisture content of a butter from a high churning temperature, and a high-temperature water increases the moisture content churned at a low temperature. The results of a high churning temperature cannot, however, be sufficiently corrected by a low temperature wash-water so as to reduce the moisture to a safe percentage.
2. That a greater loss of fat results from the higher churning temperature.

Size of grain, as influencing the moisture content.—It is not generally conceded that the larger the granules to which butter is churned the more moisture will it contain, but it is so, the reason for this being that as the churning is allowed to continue after the butter has assumed a granular form, so will the incorporation of moisture continue as the grains get larger. An experiment carried out in America is of interest, and is conclusive evidence.

Granules churned to the size of clover seed gave a percentage of 13·59 of moisture, to the size of wheat 14·75, and over-churned 20·23 per cent.

I have found the best results accrue from the following method of churning: As soon as the cream shows signs of breaking and gives the slightest clearing on the glass, the churn should be immediately stopped and washed down, using plenty of water. It is of vital importance this should be done at this time, the reason being that in the blending of cream, cream of varying ages and degrees of thickness, and from different localities, is mixed in the one vat, with the result that in the churning process it will "break" irregularly, and if the churning is continued the result will be a butter of irregular grain; but with this washing down and thinning of the cream the bulk of cream is reduced to a common thickness, which will tend to the whole of the cream breaking simultaneously, thereby producing an evenness of grain, a factor influencing the body or texture, which is desirable. Churning should now proceed and continue till the granules are the size of clover seed, when the whole of the buttermilk should be drained off. Washing should then commence by adding cool water sufficiently to prevent the butter from "rolling," and the churn be allowed to revolve five or six times, and then stopped and the washing drained away. The second washing should be done similarly to the first, with the exception that the churn should be allowed to revolve until such time as the grains are about the size of rice grains, then the washing drained away. Under normal conditions it will be found that this water is clear, but if for some reason it is not, then, and only then, should the butter be washed a third time.

The above system is suggested in the use of the concussion churn, which is the churn most universally used in this State. With open churns, the butter-maker has the various changes under his direct observation, and can regulate the inflow of water to suit these changes. It is really due to this fact that, generally speaking, butter made in open churns is of superior texture to that made in closed churns, yet there should be no reason for it.

I would here emphasise the fact that the effectual washing of butter is most essential as a preventive of "mottle," as will be pointed out in dealing with this common fault.

Methods of working as an influence on the moisture content.—The general custom in our factories is to work the butter once only, and is not only responsible (especially where incorrect churning methods are followed) for leaving much surplus water in the butter, but also conduces to "mottle."

It has been proved that the moisture content can be reduced from $1\frac{1}{2}$ per cent. to 2 per cent. by allowing the butter to stand for two hours before giving it the final working, and delay for twenty-four hours will reduce it by 3 per cent. Therefore the longer the period between salting and working, when the butter is kept at the same temperature, the drier it will be. It has been suggested (and is practised in some quarters) that a slight working prior to salting reduces the moisture content, but the result is so trifling that it would be better not to do this, as it is a sure cause of "streakiness," no matter how slightly worked. The reason for this is that the condition of the butter is so altered by working that it renders it impossible for the salt to be incorporated or evenly distributed, because the granular form is destroyed.

There can be no gainsaying that the correct way to "cure" a butter is with brine whilst the butter is still in its granular state in the churn, for then every grain comes into contact with the brine, and is more effectively "cured," and when worked the brine is thoroughly incorporated.

The disadvantages of this system are that it requires more salt and more time than dry-salting, and is less convenient, which thus places it outside the sphere of practical factory work. The system, therefore, that suggests itself as least likely to interfere with factory routine is dry-salting, and this must be done whilst the butter is as near the granular state as it reasonably can be, *i.e.*, immediately it is removed from the churn and placed on the worker. One turn of the worker, and only one, for the purpose of placing the butter evenly over the face of the table, and then the salt should be sieved evenly over it. The custom of salting whilst the worker is running should be discontinued, for obvious reasons. A slight working (say four or five revolutions of the worker) is all that is necessary for the first working, then the butter can be rolled, placed in barrows, and kept in a room with a temperature of 56 degrees to 60 degrees Fahrenheit for at least two hours, and then reworked.

The second working should proceed until the salt brine is evenly distributed, and until the butter assumes a close and firm texture, and should on no account continue till the butter is "greasy."

If, however, the butter is to be finished off in one working, the working should continue after salting until the above is obtained, say, for six or seven minutes. This latter system cannot be recommended under any circumstances unless the working-room is maintained at a temperature of 56 degrees to 60 degrees, because in working at a higher temperature "greasiness" is sure to result. Butter which has been churned at low temperature, thus delaying the coming of the butter for a long time, or butter that has been overchurned, will on working have a "greasy" appearance.

By an adoption of the manufacturing system as outlined, the faults which are constantly being pointed out on the grade certificates will be things of the past, and whereas we may not be able to hold premier place for "flavour," as the influences affecting same are very often outside a manager's control, still we can, and should, hold pride of place for "manufacture," which is wholly controlled by the manager.

(3) Condition.

This includes colour, salting, covering, and packing.

Colour.—The faults under this sub-head are streakiness and mottle, indications of imperfect colour.

"Streakiness," in my opinion, is simply an aggravated form of "mottle," the two being attributable to similar causes.

"Mottled Butter."—In nearly every two out of three boxes examined this year, the above fault was most pronounced, and I know there are managers who are perplexed at times to know the cause.

The initial cause is casein, imported into the butter by buttermilk.

I do not intend to imply here buttermilk in its crude condition, but rather a cloudy washing, the result of the insufficient washing, or unsatisfactory churning of the butter. (*Vide* remarks *re* washing of butter.)

The effect of salt on buttermilk, which is generally so incorporated as to adhere to the outer surface of the granules, is to harden the casein in such a way as to form a tough skin round the grain, thereby preventing the brine from penetrating it, the result being that those portions of the butter which come into contact with the salt brine are much deeper in colour than those which are not salted or only lightly salted, producing what are known as "blotches," or "mottles." This action is not produced instantly, but generally takes a few hours to accomplish, hence it is that a butter freshly salted may present no mottled appearance, but upon examination a few hours afterwards the mottle can be discerned.

(To verify the effect of salt on buttermilk, anyone can try the following experiment:—Fill two tumblers with buttermilk, and in one mix about a teaspoonful of salt. Allow them to stand now undisturbed for a little time, and it will be noticed that the one without the salt will show the heavier casein precipitated, but the serum or watery fluid above will be "milky" or "cloudy"; whereas in the one with the salt added, in addition to a heavy precipitate of casein, the serum is comparatively clear, and will not hold the casein, as in the unsalted, when shaken.)

"Mottles" caused by this means can be prevented by avoiding methods that retain buttermilk in any shape or form in the butter, and observing those methods that tend to the removal of buttermilk before salting. The uneven churning of the granules provides an excellent means to this end. Those grains of large size are practically the result of overchurning of this portion of the cream, and have the effect of holding locked up within themselves the buttermilk, which no amount of washing can, or will, remove.

A too low temperature of wash-water also produces "mottle," by making the exterior of the granules harder than the interior, so preventing an equal absorption of the salt, and "mottles" result.

A sudden chilling of the butter after salting will also have the same effect. Of course, as pointed out previously, if under the most favourable conditions the butter is not worked enough so as to evenly distribute the salt, "mottles" will be noticed in the finished product. Temperatures, therefore, below 50 degrees should be avoided.

Salting.—Much has been written, *ut supra*, on this point, but perhaps it would be as well to state briefly the action of salt on butter.

1. It deepens the colour.
2. It acts in a slight degree as a preservative, by inhibiting the growth of decomposing micro-organisms.
3. It reduces the moisture content (though not apparently so) by bringing the globules to the surface, where they are expelled.

Covering.—The parchment paper used by some factories is of very inferior quality, presumably on account of price. This is really a false economy, for when it is wetted, as it inevitably is, it becomes brittle and breaks away at the slightest touch, which gives the package a very unpresentable appearance.

A worse fault, however, than this exists in mouldy paper, for in time this mould works its way into the butter. It is assuredly caused by factory infection of the common mould (*Penicillium glaucum*). Where a manager's attention is drawn to this on his grade certificate he should lose no time in locating the origin, and using either a plentiful supply of lime-wash or a spray of formalin solution, the latter means for preference on account of its easy and cleanly application, as well also as its effectiveness.

In all cases where this trouble is suspected, the parchment paper should be steeped in a weak watery solution of formalin, say, a dessertspoonful of formalin to a gallon of water.

Packing.—Of all details, this is the one that seems to have received most attention, because it shows the greatest improvement. Some factories can still further improve by using a square of parchment paper on the surface of the butter, which not only prevents the butter from sticking to the parchment envelope, but also the surface from cracking along the overlap of paper when frozen, thereby enhancing its appearance.

General.—Of the butters graded this season, marked improvement in quality, generally speaking, was conspicuous, as compared with the preceding season.

A desire on the part of the majority of managers to adopt improved methods for the uplifting of their standard is evident by the manifest interest in the result of the grading of their butter. and by the inquiries made for the cause and remedy of faults. Many managers during the export period have visited the grading depôts with the above object, and for the purpose of becoming personally acquainted with the butter on arrival in Sydney.

Much food for emulation can be obtained by comparison, and it is sometimes the only way that managers can be made aware of the necessity of improvement to attain the highest standard. There are some exceptions, however, where the manager appears to disregard any effort on the part of a grader to assist him in improving his product, and it does seem to me that, with the competition for the superior article every day increasing, every effort should be put forth on the part of these men to produce at least a percentage of their output to come up to this standard, or else their reputation, and that of the factories, will suffer. This, I know, opens up a subject that is not within the scope of this paper to touch upon, but is one which the managers in conference may be enabled to go into and devise means to remedy.

Methods of Preparing Bordeaux Mixture.

Mr. S. V. Pickering, F.R.S., of the Woburn Experiment Fruit Farm, has recently investigated Bordeaux mixture, and considers that the precipitate obtained when the mixture is prepared in the ordinary way is not so efficacious as a fungicide as when lime-water (a solution of lime in water) is used in place of milk of lime (a suspension of lime in water). The object aimed at is to reduce the lime to the lowest possible proportions consistent with the precipitation of the whole of the copper present; any excess means loss of efficiency, and waste. The use of clear lime-water enables the quantity to be adjusted to this end.

Mr. Pickering's method of preparing 100 gallons of the mixture would be:—

Dissolve 6 lb. 6½ oz. of crystallised copper sulphate by suspending it in a piece of sacking, in 2 or 3 gallons of water in a wooden or earthenware vessel. Take about 3 lb. of good quicklime and slack it in a little water, then put it into a tub with 120 gallons of soft water. Stir the lime and water, then leave it to settle until the liquid is quite clear. Run off 86 gallons of the clear lime-water and mix it with the copper sulphate. This is a little stronger than "normal" Bordeaux mixture. To reduce it to that strength, make up to 100 gallons with soft water.

At the suggestion of Mr. G. P. Darnell-Smith, Assistant Microbiologist, Bureau of Microbiology, Mr. Pickering's method is being tested at several of the Department's orchards, and reports of the results will be published in due course.

Circular Letter to New South Wales Butter Factory Managers.

M. A. O'CALLAGHAN.

Re Butter Exports and Commerce Act.

WITH reference to the forthcoming export season, I desire to draw attention to certain matters in connection with the Commerce Act, so that we may be able to do the work this year without any friction whatever between the Inspectors under the Act, and factory managers or exporters.

Last year a distinct advance was made in the quality and get-up of New South Wales export butter; but we should not rest satisfied with this, as a great quantity of butter exported from New South Wales is still inferior in flavour, manufacture, and general appearance. No doubt this is due to a certain extent to the fact that butters are exported now and again which were never intended to be exported by the factory managers at the time the butter was being made. For instance, at the present time a large number of butters are being shipped that have been some months in cold store, and judging by the manufacture of these, and their general appearance, they were never intended for export by the managers of the factories in which they were made. Some of these butters bear brands on the boxes representing the *first-class brands* of factories, and it is undoubtedly against the interests of these factories that inferior butters should be shipped under their best brands, especially at the beginning of the export season. This is a matter, however, between the exporter and factory manager, and one in regard to which the Commerce Act officials can exercise no authority.

Excess Water in Butter

During the year ended 30th June, 1910, seventeen brands of butter were submitted for export which were found to contain an excessive quantity of water. This really means that had the Inspectors not noticed these butters, and stopped their export, it was possible that seventeen cases for the sale of adulterated butter in England might have been brought against New South Wales exporters, to the detriment of the reputation of New South Wales butters and to the injury of the producer. Under the circumstances, too much stress cannot be laid on the fact that every factory manager should make it his duty to see that no butter leaves his factory, whether intended for export or not, which contains an undue percentage of water.

While on this point, it may be well to state that the two main factors influencing the percentage of water in butter are churning temperature and butter-working temperature. If the churning temperature is high, it is

almost certain that the butter will contain a high percentage of water under ordinary methods of manufacture. Again, even though the churning temperature may be normal, if the room in which the butter is being worked is very high in temperature, it will not be possible to express all the excessive moisture from the butter without over-working it. This is especially true in the case of unsalted butters; hence manufacturers are requested to pay special attention to these points whenever they notice that their butters present the appearance of containing a large quantity of water.

Short-weight Butter.

Closely connected with the question of excessive water is that of short weight, because a great deal of the short weight is due to the fact that water leaks out of the butter between the time of packing at the factory and that of weighing the butter off in Sydney. In all, 135 cases of short weight were detected in butters submitted for export last year. This meant a considerable amount of expense to the factories, apart from the fines which were imposed; and it also meant a lowering of the standard of our butters, because the appearance of any boxes of butter which have to be brought up to the standard weight of 56 lb. is not as good as it would have been had the boxes not been in any way interfered with. The factory managers will thus see the wisdom of paying close attention to the weighing of the butter; and no factory can be considered to be properly equipped unless there is therein a correct 56-lb. weight with which the scales can be tested every morning. If this is done, and if a full ½ lb. of butter is allowed for shrinkage, we shall hear very little about short weights, unless in the case of wet, leaky butters, from which a lot of moisture gets away.

Excess of Preservative.

On twenty occasions during the year an excessive amount of preservative was discovered in butters which had been submtited for export. These butters had to be reworked and mixed with butter which contained no preservative before they were allowed to be exported; consequently considerable expense was incurred and unnecessary tax placed on the producer. But the case would have been very much worse if these errors had not been detected prior to the shipment of the butter, because then New South Wales would have got a very bad advertisement indeed, through prosecutions in England for the sale of adulterated butters.

Question of Butter Boxes.

It has been brought under my notice that it is the intention of some factories to use second-hand boxes for the purpose of packing butter for export. Whereas there is no legal objection to same, provided the brands are not infringed in any way, still it is desirable to draw the attention of factory managers to the fact that unless the boxes present a good appearance the butters may lose a considerable number of points when being examined,

and, apart from this, the sale of the butter is prejudiced considerably in England if the appearance of the package indicates that the butter has been submitted for sale previously. Butters that have been rejected by the purchaser as below the quality ordered have generally that dirty appearance which butters get by having been carted and railed from place to place. Needless to say, it is impossible for the seller to obtain a fair price for butters that are thus affected. New South Wales manufacturers should therefore be careful not to use boxes which will convey the impression to the purchaser in England that he is looking at second-hand butters.

I shall be very glad to help you in any way with any question that troubles you during the coming year; and if there is any point on which you are not clear, I shall be obliged by your communicating with me. The desire of the Department of Agriculture and of the Department of Trade and Customs is to maintain the standard of our superior butters, and to uplift the standard of the inferior ones; and we hope that your efforts as well as ours will have a material result in this direction during the forthcoming season.

WATER CONTENTS OF EXPORT BUTTERS.

M. A. O'CALLAGHAN.

As the question of water in butter is being discussed at length at the present time by factory managers, merchants, and others, it will be of interest to let managers see the results of the analyses of those butters that have been exported recently.

Most of the butters in question have been in cold store for a considerable time—some for two or three months—and hence it is only natural to expect that a considerable amount of water has leaked therefrom, so that it should be assumed that the butters when manufactured contained a higher percentage of water than is indicated by these results. Unfortunately, we have considerable proof of this, because a number of the butters in question showed considerable shrinkage in weight, due to the leakage which had taken place therefrom. For the period between the 9th August and 9th September, 108 samples of butter were examined for water, and of those—

- 3 contained under 10 per cent., with an average of 9·17 per cent.;
- 5 samples contained over 10 per cent. and under 11 per cent., with an average of 10·57 per cent.;
- 15 samples ranged between 11 per cent. and 12 per cent., with an average of 11·51 per cent.;
- 21 samples ranged between 12 per cent. and 13 per cent., with an average of 12·54 per cent.;
- 33 samples contained over 13 per cent. and under 14 per cent., with an average of 13·42 per cent.;
- 19 samples contained over 14 per cent. and under 15 per cent., with an average of 14·31 per cent.;

11 samples contained over 15 per cent. and under 16 per cent., with an average of 15·37 per cent.;

1 sample just exceeded the 16 per cent. standard, giving 16·09 per cent. of water.

The average for the entire number came to 13·12 per cent. of water.

It will thus be seen that the average number range between 13 per cent. and 14 per cent. of water, though for an export butter we would have preferred to have seen the majority run between 12 per cent. and 13 per cent. of water, as undoubtedly better-keeping quality is obtained by the use of preservative when the water-content of the butter is low.

No doubt a large number of these butters were never intended for export, because they were made during the non-export season of the year, and owing to want of demand for anything but high-class butters in Sydney they must necessarily be exported for sale.

Some of these butters bore the first-class brand of the factory in which they were made, but the quality was only third-class; and here is a question which factory directors may well take up and consider carefully.

In my opinion it would have been far wiser to have re-boxed these inferior butters and shipped them under other brands, so that the best brand of the factory would not be prejudiced in the eyes of the English customers at the very beginning of the export season.

The Pear Blight in California.

Under this heading, Professor R. E. Smith, of the University of California, writing in the *Pacific Rural Press,* makes some suggestions which may be worthy of consideration by our orchardists in dealing with some of our fruit diseases. Fortunately, so far as is known, the "Fire Blight" (*Bacillus amyllovorus*) is unknown here. It is caused by a germ which frequently infects the young suckers near the butt, works down below the ground, and kills the tree. The Bartlett pear is the variety most generally grown, and it seems particularly susceptible to the blight. The abandonment of the Bartlett would practically mean the abandonment of the pear industry.

A remedy suggested is the grafting of the Bartlett on the trunk of a variety more resistant to blight and less given to suckering. Bartlett trees grafted on Le Conte have made much more vigorous growth than Bartlett on the ordinary root. The object is to confine the disease, as far as possible, to the top of the tree, where it can be more readily seen and handled, and where its effects are not so disastrous. The Bartlett on Le Conte, however, is slow in coming into bearing, and a suggestion is made that the trees be double-worked, with the Hardy between the Le Conte root and Bartlett top. No reason is given why the Hardy should not be used direct as a stock in place of Le Conte, as the former is stated to be quite free from blight.

It is also stated that Bartlett and other varieties are far less liable to blight as dwarf trees than as standards. The dwarf trees are on quince roots.

Orchard Notes.

W. J. ALLEN.

OCTOBER.

Cover Crops.

WHERE green-manure crops have not already been turned in, this work should be finished as early as possible now, as there is always the chance of the season proving a dry one, in which event such crops would soon remove the moisture from the ground, and render it almost impossible to plough properly. Where the soil turns up lumpy and dry, the crop will not rot in the same way as it would were the ground in a good, moist condition at time of ploughing.

Cultivation.

Throughout the spring and summer months, occasional cultivations should be given to orchards and vineyards; also after each rain the ground should be well worked to conserve as much moisture as possible, and prevent excessive evaporation. Under no circumstances should this important work be neglected. The soil around the base of all trees and vines should be loosened up to a good depth with a pronged hoe in the early spring, and occasionally during the summer, and any suckers found growing on either trees or vines should be removed.

Fighting Codlin Moth and other Pests.

Growers of apples and pears should spray their orchards systematically with arsenate of lead, in order to protect the fruit from the ravages of Codlin moth. It has been proved time and again that those who spray systematically, bandage, and pick up and destroy all fallen and infested fruit succeed in harvesting over 90 per cent. of clean fruit, while those who neglect spraying are lucky if they succeed in harvesting 40 per cent. of clean fruit.

To comply with the regulations under the Fruit Pests Act, it is necessary to attach the bandages to all apple, pear, and quince trees now, and those who fail to do so render themselves liable. It has been found that either a copper nail or a large shawl pin is the best and most simple means of fastening on the bandages.

Black Spot of the Apple and Pear.

It is now too late in most places for the winter dressing, which should be applied a few days before the trees burst into leaf and bloom. The second spraying should be given as soon as the fruit is well set, and may be used

in conjunction with arsenate of lead. For the first application, before the tree bursts into bloom, the following solution may be used:—

Copper sulphate (bluestone)	6 lb.
Lime..	4 lb.

made up with 22 gallons of water; while for the second spraying it may be diluted to 50 gallons.

Experiments with several formulæ of Bordeaux paste and mixtures of varying strengths are being conducted in the Orange district, in order to try and ascertain which will prove most effective in controlling this disease, and at the same time be least injurious to the fruit. Bordeaux mixture at times, and particularly with some varieties of apples, is liable to cause a russeting of the fruit, which is objectionable.

In spraying, use as fine a nozzle as possible, and see that the whole of the tree, leaves, and fruit are covered.

Dormant Buds and Grafts.

Keep all worked stock well disbudded, never allowing suckers to grow where either bud or graft is doing well. If the stocks on which buds were inserted have not been cut back, this should be done without further delay.

The cut should be slanting, being slightly lower on the side opposite the butt; and it is advisable to stake them; not only to prevent their being blown out, but also to encourage a straight trunk.

A well-grown two years' old Orange tree in the orchard of Mr. H. J. Ball, Wentworth.

Where grafts have been put in old trees, they must be tied to prevent their being blown off. To do this, a good stake should be tied to the branch grafted, and allowed to project a foot or more over the end; then, as the graft grows, it can be tied to it.

Keep a strict watch on all refills and young trees, and if these show any signs of wilting, give them one or two buckets of water from time to time until they get a good start. Disbud all newly-planted trees, leaving three or four good shoots, at least 4 inches apart, along the trunk of the tree. Do not allow two or three shoots to start from the same place, but give each branch a separate hold of the main stem. While working around trees, watch for borers on the trunks and branches, as it is very easy, when they are just starting their work, to cut away the bark and find them, thus keeping the orchard free of this pest.

Pruning of the old citrus trees may be completed this month.

Irrigation.

It is more than likely that the first irrigation of the season will have to be given all trees and vines some time this month. Therefore, see that all furrows are well made. These should be deep rather than shallow; and while irrigating, see that no water is allowed to flood over the surface of the soil nor lodge around the trunks of trees.

When watering, give the land a good soaking, taking care to see that the water reaches the roots of all young trees and vines.

Immediately the ground is dry enough to work, see that it is worked up to a good depth with proper implements. Also have the soil in the immediate vicinity of trees and vines well worked up with a fork hoe.

Government Stud Bulls available for service at State Farms, or for lease.

Breed	Name of Bull.	Sire.	Dam	Stationed at—	Engaged up till—
Shorthorn	Pansy Duke	Earl March	Pansy 4th (imp.).	Wollongbar Farm	†
,,	March Pansy	Earl March	Australian Pansy.	Grafton Farm	*
,,	Royal Hampton 10th (imp.).	Soliman	Orange Blossom 23rd.	Berry Farm	*
Jersey	Thessalian II.	Thessalian (imp.).	Egyptian Princess (imp.).	Wagga Exp. Farm	*
,,	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm	*
Guernsey	Gentle Prince	Rose Prince (imp.).	Gentle	Wyrallah	7 Mar., '11.
,,	The King's Mirror.	Calm Prince	Vivid (imp.)	Lismore	10 April, '11.
,,	Star Prince	Calm Prince	Vivid (imp.)	Dunoon	3 April, '11.
,,	Prince Souvia	Vivid's Prince	Souvenir (imp.)	South Woodburn	21 Dec., '10.
,,	Monsieur Beaucaire.	Calm Prince	Flaxy (imp.)	Wollongbar Farm	*
,,	Claudius	Golden Star II.	Claudia's Pride (imp.).	H.A. College, Richmond	*
,,	King of the Roses	Hayes' King	Rose 8th (imp.)	Berry Farm	*
,,	Royal Preel	Otchen Royal	Hayes' Lily du Preel (imp.).	Wollongbar Farm	*
Red Poll	The Judge	Barrister (imp.)	Lovely 8th (imp.).	Grafton Farm	*
Ayrshire	Don Juan	General (imp.)	Judy 9th (imp.)	Bathurst Farm	*
,,	Royal Prince	Curly Prince	Rosie 5th	Grafton Farm	*
,,	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm	*
,,	Jamie's Ayr	Jamie of Oakbank.	Miss Prim	Wollongbar Farm.	*
,,	Dan of the Roses	Daniel of Auchenbrain (imp.).	Ripple Rose	H.A. College, Richmond	*
Kerry	Kildare II	Kildare (imp.)	Belvedere Bratha 3rd (imp.).	,, ,,	*
,,	Bratha's Boy	Aicme Chin (imp.).	Bratha 4th	,, ,,	*
,,	Rising Sun	Bratha's Boy	Dawn	Bathurst Farm	*
Holstein	Hollander	Bosch III. (imp.)	Margaretha (imp.).	Berry Farm	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

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Department of Agriculture,
Sydney, 4th October, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

AYRSHIRES.—Lord Roseberry: sire, Auchenbrain Spicy Jock (imp.); dam, Primrose II; calved 15th December, 1908; colour, brown and white. Price, **£20.**

Primrose II is by General from Miss Prim. Miss Prim is by Mischiefmaker (imp.), from Primrose of Barcheskie (imp.). Primrose II is a beautiful cow, showing great milking and show type, with large teats and udder. Miss Prim is pronounced by our best judges to be one of the best cows in the State. A recent visitor from New Zealand declared they had no cows to compare with Rose Berry, Primrose II, and Miss Prim.

* **Romeo:** sire, Auchenbrain Spicy Jock (imp.); dam, Juliette; calved 12th May, 1909; colour, dark brown and white. Price, **£25.**

Juliette is from Judy 9th of Barcheskie (imp.), by Mischiefmaker (imp.).

* **Sandy:** sire, Auchenbrain Spicy Jock (imp.); dam, Rose Flower; calved 8th April, 1909; colour, brown and white. Price, **£20.**

Rose Flower is from Roseberry, by Daniel of Auchenbrain (imp.). Roseberry from Roseleaf of Barcheskie (imp.), by Mischiefmaker (imp.).

GUERNSEY.—* Halley's Comet: sire, Star Prince; dam, Flaxy II; calved 1st September, 1909; colour, lemon and white. Price, **£45.**

Flaxy II is from Flaxy (imp.), by Rose Prince (imp). Star Prince from Vivid (imp.), by Calm Prince.

Halley's Comet has a double cross of Rose Prince blood.

HOLSTEIN.—* Keizer: sire, Hollander; dam, Maggie Obbe; calved 22nd October, 1909; colour, brown and white. Price, **£10.**

HAWKESBURY AGRICULTURAL COLLEGE.

AYRSHIRES.—Dado: sire, Daniel of Auchenbrain (imp.); dam, Dot, by Hover of Southwick (imp.), from Flirt, by Heir of Randwick (imp.), from Lady of Randwick; calved 23rd March, 1904; colour, white and brown. Price, **£20.**

Emerald's Mischief: sire, Prince Emerald (imp.): dam, Miss Prim, by Mischiefmaker of Barcheskie (imp.), from Primrose of Barcheskie (imp.), by Royal Stuart of Glenbuck, from Lindsay 7th of Barcheskie; calved 4th August, 1903; colour, white and red. Price **£30.**

WOLLONGBAR EXPERIMENT FARM.

HOLSTEIN.—De Wet: No 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909. Price, **£10.**

AYRSHIRES.—*Colonel: No 211. Sire, Jamie's Ayr; dam, Colon; calved 26th December, 1909; colour, red and white. Price, **£15.**

* **Royal Jamie:** No. 203. Sire, Jamie's Ayr; dam, Roydy; calved 29th October, 1909; colour, white and red. Price, **£15.**

* **The Pretender:** No. 200. Sire, Jamie's Ayr; dam, Juda; calved 25th October, 1909; colour, white and red. Price, **£15.**

GUERNSEY.—* Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909. Price, **£45.**

H. C. L. ANDERSON,
Under Secretary.

* Applications for these bulls will be held till 21st October. If more than one application be received for any one bull, his disposal will be decided by ballot.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Adelong P. and A. Association	A. W. Molineaux	Oct 4, 5
Crookwell A., P., and H. Society (Spring Show)	M. P. Levy	„ 7
Wallsend and Plattsburg A. Society	R. Maddison	„ 21, 22
Mullumbimby A. Society	N. Neilsen	Nov. 9, 10
Tweed River A. Society (Murwillumbah)	A. E. Budd	„ 16, 17
Newcastle A. H. and I. Association (Spring Show)	C. W. Donnelly	„ 18, 19
Lismore A. and I. Society (State National Show)	T. M. Hewitt	„ 22-25

1911.

Society.	Secretary.	Date.
Albion Park A. and H. Association	H. G. Fraser	Jan. 18, 19
Kiama A. Association	R. Somerville	„ 25, 26
Alstonville A. Society	W. W. Monaghan	Feb. 8, 9
Berry A. Association	C. W. Osborne	„ 8, 9
Moruya A. and P. Society	P. Flynn	„ 8, 9
Coramba District P., A., and H. Society	H. E. Hindmarsh	„ 15, 16
Shoalhaven A. and H. Association (Nowra)	H. Rauch	„ 15, 16
Gunning P., A., and I. Society	J. L. Sands	„ 22, 23
Manning River A. and H. Association (Taree)	S. Whitbread	„ 22, 23
Kangaroo Valley A. and H. Association	J. Moffit	„ 23, 24
Wyong A. Association	J. H. Kay	„ 23, 24, 25
Southern New England P. and A. Association (Uralla)	W. C. McCrossin	„ 28, Mar. 1, 2
Inverell P. and A. Association	J. McIlveen	„ 28, Mar. 1, 2, 3
Robertson A. and H. Society	R. J. Ferguson	Mar. 2, 3
Bowraville A. Association	C. Moseley	„ 2, 3
Gundagai P. and A. Society	A. Elworthy	„ 7, 8
Bangalow A. and I. Society	W. H. Reading	„ 7, 8, 9
Tenterfield P., A., and M. Society	F. W. Hoskin	„ 7-11
Bombala Exhibition Society	W. G. Tweedie	„ 8, 9
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	„ 8, 9
Macleay A. H. and I. Association (Kempsey)	E. Weeks	„ 8, 9, 10
Crookwell A., P., and H. Society (Annual Show)	M. P. Levy	„ 9, 10
Berrima District A., H., and I. Society (Moss Vale)	I. Cullen	„ 9, 10, 11
Central New England P. and A. Association (Glen Innes)	G. A. Priest	„ 14, 15, 16
Cobargo A. P. and H. Society	T. Kennelly	„ 15, 16
Tumut A. and P. Association	T. E. Wilkinson	„ 15, 16
Bellinger River A. Association (Bellingen)	S. S. Hindmarsh	„ 15, 16, 17
Mudgee A. Society	H. Lamerton	„ 15, 16, 17
Port Macquarie and Hastings District A. and H. Society	W. R. Stacy	„ 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	„ 16, 17, 18
Luddenham A. and H. Society	W. Booth	„ 21, 22
Armidale and New England P., A., and H. Association	A. McArthur	„ 21-24
Camden A., H., and I. Society	C. A. Thompson	„ 22, 23, 24
Clarence P. and A. Society (Grafton)	T. T. Bawden	„ 22, 23, 24
Taralga A. P. and H. Association	G. C. Goodhew	„ 23, 24
Newcastle A. H. and I. Association (Annual Show)	C. W. Donnelly	„ 23, 24, 25
Blayney A. and P. Association	E. J. Dann	„ 28, 29

Society.	Secretary.	Date.
Lower Clarence A. Society (Maclean)	F. W. Collison ...	Mar. 28, 29
Walcha P. and A. Association	J. New-Campbell	,, 28, 29
Yass P. and A. Association	W. Thomson ...	,, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 5, 6
Dorrigo A. Society	F. T. Stennett ..	,, 5, 6
Dungog A. and H. Association	C. E. Grant ...	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 5, 6, 7
Royal A. Society of N.S.W. (Sydney)..	H. M. Somer ...	,, 11–19
Queanbeyan P., A., H., and I. Association	E. C. Hinckxman	,, 12, 13
Bathurst A., H., and P. Association	A. H. Newsham ..	,, 26, 27, 28
Richmond River A. P. and H. Society (Casino) ...	D. S. Rayner ..	May 3, 4
Orange A. and P. Association	W. Tanner ...	,, 3, 4, 5
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	Aug. 22, 23, 24

Contributions to the Farrer Memorial Fund.

Name.	Address.	£	s.	d
Amount received to 20th August, 1910		902	8	10
John Coote	Ribey Grove, Upper Manilla ...	1	1	0
F. Atherton	Thalaba, Millie	1	1	0
W. Morgan	Hillgrove	1	1	0
Agricultural Association	Bowraville	1	1	0
Do do	Ulladulla	2	2	0
P. and A. Association...	Warialda	1	1	0
Hunter River A. and H. Association	West Maitland	3	3	0
F. and S. Association	Inverell	1	1	0
Do do	Glencoe	1	0	0
Do do	Trundle	10	11	6
Do do	Savernake	2	0	0
Do do	The Rock...	1	0	0
J. F. Roddinott	North Parramatta	0	5	0
"Anti-Dreadnought"	do	0	10	6
H. M. Suttor & Co.	Bond-street, Sydney	2	2	0
A. Brunskill	Wagga	1	1	0
G. H. Hubbard	Maryvale	1	0	0
H. Martin	Exton, Tasmania	0	10	0
Manilla Milling Co.	Manilla	1	1	0
Manning River A. and H. Association	Taree	1	1	0
R. Shoobridge	Glenora, Tasmania ..	1	1	0
P. J. O'Keefe	Duranbah, Tweed River ...	0	10	0
Upper Hunter P. and A. Association	Muswellbrook	5	5	0
Total amount received to 21st September, 1910 ...		£942	17	10

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Agricultural Gazette of New South Wales.

Sheep and Wool for the Farmers.

THE USE OF BREEDS.—THE QUESTION OF WOOL.

J. WRENFORD MATHEWS.

IN these articles attention has thus far been mainly directed to the history and characteristics of the breeds now in more general use in Australia. In the August issue of the *Gazette*, we endeavored to trace the gradual evolution of the British breeds, and to indicate their comparative suitability for wool or mutton production, or both. On the maintenance of these breeds, and the persistence of the special qualities of each, the future of the great sheep industry largely depends.

Our object in this article is twofold. In the first place, we must determine how the distinct characteristics of such breeds can be most profitably utilised in the evolution of the best types for any given conditions. Then we must lay down on fairly definite lines a system of mating such that the maximum profit from wool or mutton may be realised from the progenies.

Contrast between English and Australian Practice.

In the Old Country, breeds are used in a pure state, the sheep most suitable to the peculiar conditions of the locality being, of course, chosen in each case. So different are Australian conditions, however, that the results of English experience are of little assistance. Moreover, the English sheep-farmer makes his chief profit from the mutton. Wool is with him a matter of very minor importance. In Australia this position is exactly reversed. Our main profits come from the wool clip; indeed, many of our most prominent sheep-breeders derive their entire income from this source, and in the past buyer and seller alike have been content to take the value of the clip as an index of the worth of the run.

But the English sheep-farmer would never dream of setting up any such standard of value, nor would Australian methods ever pay in the Old Country. There the sheep must be much more promptly turned to account. Feeding is a very costly item, and so the Englishman never holds his sheep any longer than he can possibly help. Great Britain has a population of something over forty millions, and mutton is one of their main articles of diet; so that the English grower has a great and rapidly-increasing demand to meet—a demand which Australia already in part supplies. Under these circumstances, it is not to be wondered at that the English sheep-farmer favours that breed of sheep which will, under his particular local conditions, yield him the maximum quantity of prime mutton, and grow to a marketable size in the shortest possible time. It is interesting to note in this connection that the Merino is not to be found in Great Britain, nor will it thrive there.

So that, although Australian growers are beholden to the English breeders for the valuable agricultural types of sheep now in Australia, yet, had it not been for the evolution, in Australia, of the Merino, as we now know it, even the possession of those valuable British strains could never have enabled us to enter, as we are doing, upon an entirely new era in the history of sheep-breeding.

The Value of the Cross-bred.

As has been already indicated, the Merino is the pre-eminent wool type, but the Merino is not the only wool type. The world's aggregate wool production includes rather more cross-bred than pure Merino wool. The cross-bred sheep yields a very serviceable class of wool for certain needs. Were it not for cross-bred wools, woollen goods would still be too much of a luxury even for people in moderate circumstances. But the production of these wools of coarser quality makes it possible to supply fairly smart and certainly serviceable clothing at quite a moderate cost. Almost every manufacturer of note throughout the world is now devoting a fair share of his attention to cross-bred wools, and although at present Australian cross-bred wools form but a small proportion of our total exports, they can, nevertheless, command the highest prices in the world's markets.

Cross-bred sheep, grazing on rape and barley, Bathurst Experiment Farm.

For the production of such valuable cross-bred wools, many districts of this State are highly suitable. The British breeds, in their pure state, are accustomed to colder temperatures than the average in the agricultural areas of this State The Merino, in its pure state, is essentially the sheep of the dry country. In great areas of the agricultural country of New South Wales, however, there is to be found a climate neither as cold as that of Britain, nor as dry as that of western Riverina, and it is in such districts as these that the cross-bred sheep is seen to the greatest advantage as a wool producer.

But it is not alone as a wool producer that the cross-bred deserves attention. By virtue of his British ancestry, and consequent larger body and earlier maturing qualities, the cross-bred yields a profitable carcase, and ranks as a good mutton type as well. Such a combination of qualities makes the cross-bred a typical farmer's sheep, and it seems remarkable that the very sheep that forms the most valuable adjunct to farming should thrive best in the very districts most suitable for agriculture.

Sheep must be Fed.

It is a matter of common knowledge among experienced sheep men, that the heavier-bodied and deeper-woolled breeds require a food supply correspondingly greater. Especially is this the case where there exists the heavier demand made by a rapid increase in body weight. It naturally follows either that pastures must be more lightly stocked, or that extra feed must be supplied to the stock.

To understock pastures means that a certain percentage of the land is going to waste. It has been already claimed that the best returns follow from the employment of fodder crops; the question was treated at greater length in the January issue of this *Gazette.* At first sight it might appear a costly plan, but it has been thoroughly tested in other countries, especially in Great Britain, and the unanimous verdict is that it is well worth while. Such crops can be much more easily grown in Australia, and the plan has been sufficiently tested here to establish the soundness of the system.

In the evolution of the British breeds from their primitive representatives, feeding has played a most important part. Their gradual perfection has gone hand in hand with the development of agriculture. Hence it is difficult to see how we can hope to make a success of these breeds unless we follow as far as possible similar methods in Australia.

Cross-breeding.

Certain definite principles govern the evolution of wool and mutton types. The greatest success is always attained by the man who has at all times a perfectly definite object in view. Our markets for wool and mutton are well defined, and both of them are within the reach of the practical farmer. In view of this double demand, he may direct his attention to breeding a sheep, as far as possible, that will give the best return from either—

(1) The wool clip; or
(2) The export lamb trade.

Both demands are great, and the sheep-breeder may aim at meeting either or both of them. But he must definitely decide what his exact aim is to be; otherwise he is doomed to disappointment and loss.

The farmer's best plan, if he breeds for wool, is to consider quantity rather than quality, and to aim at weight of fleece. If catering for the early lamb trade, the breeds used must be such as to secure increased early maturity. Profits from this source are promptly realised; probably no branch of the sheep industry furnishes such quick returns. The profits from a four or five months' lamb are greater than those of a whole year's growth from even the best-paying wool types. But this fact must not delude the farmer into the idea that wool is of little or no consequence. While the lamb is being reared for the export trade, the ewe is growing wool, and it is highly important that this wool should be of the most valuable kind and quantity possible under these circumstances. The object in cross-breeding should be to secure a breed profitable at the same time for both wool and mutton.

This combination is under all circumstances most difficult to secure. Conditions vary so widely that the cross most successful in one locality might prove a complete failure in another. Without first-hand knowledge of local conditions, any hard and fast rule by which mating should be carried out cannot possibly be laid down. Only the main principles can be stated, and the farmer, having once grasped these, must be prepared to decide, from his own local knowledge, on the extent to which such principles must be modified. Locality is always a large factor in the resultant type. The farmer who will make a success of sheep breeding is the man who takes an intelligent interest in his sheep and their descent. It cannot be too strongly emphasised that mating should always be conducted on the soundest practical lines, and that the indiscriminate use of breeds is absurd, unprofitable, and dangerous.

Breeding for Wool.

The choice of breeds suitable for this purpose is limited; it must be the Merino, or else a cross-bred type derived from the Merino. In either case prevailing climatic conditions must receive here, as in all other cases, the most careful consideration, and the agricultural methods, if any, must be taken fully into account. Should a cross-bred be decided upon, such types of the British breeds should be selected as will give increased length of staple in combination with softness, good "crimp," and lustre. Length is of first importance where cross-bred wools are concerned. Length is a valuable contribution to weight; yet even this obvious fact is often lost sight of by those breeders who raise cross-breds. Length of fibre should always be strictly proportioned to "quality," or its degree of fineness. The finer the quality the shorter is the staple. If "quality" be lessened, as, for example, by crossing a British breed with the Merino, the British sheep chosen for the cross must possess such characteristics as will give a correspondingly increased length and weight of fleece to more than make up for the decrease in fineness, and therefore in price per pound. Buyers continually complain of the number of short fleeces of low quality submitted from time to time, and it is strange how any breeder with any experience in cross-bred sheep should be satisfied to market such an exceedingly unprofitable class of wool. Such an undesirable fleece never realises even its fair market value, as judged by length and quality. Where necessary it pays to see that all sheep carrying short, stumpy fleeces, usually of poor, harsh character, are rigorously culled out. Thus the choice of the British strain to be employed will largely determine length of wool and consequent market value. This general principle must never on any account be disregarded if the breeder aims at producing a high-class cross-bred wool.

The Choice of the Merino.

Almost equally important is the securing of the right type of Merino. Though the Merino is regarded generally as a fine and dense-woolled breed, yet for purposes of cross-breeding some strains of Merino are much more suitable than others. In view of the fact that the farmer is aiming at size

rather than fineness, he should employ the biggest-framed and longest-woolled type of Merino possible, even if he should find it necessary to go in search of them to those distant western districts of which they form the typical sheep. The greater profits obtainable from cross-bred wools derived from such Merino strains would more than repay him for the extra trouble and cost. In the past it has too frequently been supposed that any class of Merino was good enough for the raising of cross-breds. As a matter of fact, just as much careful attention must be bestowed on the evolution of cross-breds as of the highest types of Merino or British breeds. Indeed, in the more arid interior parts it would perhaps pay better to use the Merino in a pure state. Few more profitable classes of sheep are to be found anywhere than the big-framed Merino of the drier areas, and for such regions this deeper-woolled type is the strain recommended.

Big-framed Merino Ewes, suitable for mating with the Long-wools.

Long-wools

When the British breeds were briefly referred to in a previous article (August, 1910), the types were so grouped as to make their special characteristics more readily apparent. Before discussing the value of those British breeds as factors in the evolution of wool types, it may be instructive to glance again at the position of the sheep selected in the two main groups. It is with the Long-wools that we are first concerned. The breeds comprising the second group are more suited to the production of mutton, and will be more fully dealt with under that heading. The Long-wool breeds, Lincoln, Cotswold, Leicester, Border Leicester, Romney Marsh, and Cheviot, are "named in their order of decreasing fleece production and increasing early maturity."

Original Wool Types.

So even among these Long-wools there are to be found marked differences in wool and mutton-producing qualities. Each of these sheep has its own particular qualities and its own special part to play in the production of a profitable wool type. Nevertheless, there stands out prominently among the group those noted as the heavier and more prolific wool-producers.

We must not, moreover, by any chance overlook the fact that definite descent, which is only another expression for purity of type, plays a most important part in breeding, and a not less important part in cross-breeding.

The laws of propagation and prepotency are matters outside our control; but any experienced breeder knows that in the endeavour to reach any ideal the oldest and purest strains form the best basis. An original animal or plant variety has much more strongly marked prepotent powers than the newer and more artificial varieties derived from it.

The Lincoln among Long-wools, like the Merino among Short-wools, is the "first family," the aristrocat of ancient lineage. Any investigation of breeds and any system of mating must prove largely futile unless the facts of the long descent of the Lincoln and its gradual evolution are clearly grasped. From our present point of view, therefore, it is of the keenest interest to contrast the truest of wool types, the Merino, a comparatively small and fine sheep, with the large, gaunt-framed Lincoln.

The Lincoln is famous for its long, lustrous fleece. The wool of the Merino is short, fine, and dense. Lincoln wool often reaches a foot or more in length. Merino wool is not more than a third of this length, but exhibits a corresponding degree of fineness. We may justly claim for Australia the possession, as far as present-day wool types are concerned, of sheep which it is no exaggeration to describe as the height of perfection.

If we compare the wool produced by the best of our plain-bodied Merino rams with that of the Lincoln, we find that, although the sheep are distinct in almost every particular, the weight of wool, remarkable as this may appear, is approximately the same in each case. Our high class plain-bodied Merino stud rams cut a fleece of from 25 to 30 lb. weight and upwards, and it is not uncommon to find amongst the more noted Lincoln breeds sheep that will yield upwards of 30 lb. for a year's growth. This goes to show that these breeds, now distinct, have by definite descent attained purity of type. Consistent with the preservation of body and mutton-producing qualities, no other breed can in any way approach the Lincoln as a wool sheep.

The Lincoln and Merino are specially fitted to thrive under totally different circumstances. The Lincoln is at home in a cold climate. The Merino is naturally adapted to the warmer and drier climate which Australia largely possesses. Thus in these two breeds we have the base from which all sound attempts to evolve the most profitable intermediate wool type—intermediate, that is, between Long-wool and Short-wool—must surely begin.

(*To be continued.*)

Regulations in respect to the Analysis of Soils, Manures, Fodders, &c.

As it is found that the privilege conceded to farmers of having their products analysed by the Department is continually sought for by men of business and others not entitled to this concession, it is hereby notified that analyses for persons other than farmers can only be undertaken under exceptional conditions.

Attention is therefore drawn to the following Regulations:—

Regulations relating to Analyses performed in the Chemical Laboratory, Department of Agriculture.

Analyses of soils, fertilisers, fodders, plants, wheat, flour, water for irrigation or for watering stock, farm produce generally, insecticides, preservatives, &c., &c., are made by the Chemist gratis for *bonâ fide farmers and settlers, resident in New South Wales, only.*

No analyses will be undertaken for commercial purposes. These should be made by chemists outside the Department.

An exception is made in the case of manure manufacturers, or their agents, who wish to have analyses made of samples taken from bulk for the purpose of insertion in the annual list of fertilisers in the market published by the Department.

If it should be found that any farmer has taken advantage of this privilege of having gratis analyses made in order to have articles analysed for commercial purposes or for people not entitled to this concession, such privilege will be withdrawn from him, and he will no longer be entitled to have analyses made by the Department.

The Department reserves to itself the right of refusing to analyse any sample sent.

In cases where the Minister, after consideration, consents to an analysis being performed for persons other than farmers (with the exception mentioned above) a fee, payable in advance, will be charged as under:—

	£	s.	d.	
Manures—				
Blood, &c.	£2	2	0	each.
Bone-manures, meat and bones, &c.	3	3	0	„
Mixed fertilisers	4	4	0	„
Soils—Complete analysis	5	5	0	
Water—For irrigating or watering stock	2	2	0	
Milk, butter, cheese, &c.—Complete..	2	0	0	
Wines—Complete	3	3	0	
Wheat—Milling sample	2	2	0	
Flour	1	1	0	

If complete analyses are not required, the analysis will be charged for at the rate of 15s. for each determination, but if only a single determination is made, this will be charged for at the rate of £1 1s.

Certificates for Export purposes.

In a number of cases in which locally-made products are shipped abroad, a certificate of analysis issued by the Department is insisted on. In order to assist the development of the export trade, the Minister has decided that in cases where it can be shown that a Government certificate is required, such certificate will be supplied, and the analysis made, at the following rates:—

Blood manures	£1	1	0	each.
Bone manures	1	1	0	,,
Meat and bone manures	1	1	0	,,
Flour	0	10	6	,,
Wheat—Milling certificate	1	1	0	,,

Instructions for forwarding samples for analysis.

All samples should be addressed to the Under Secretary, Department of Agriculture, and be accompanied by a letter giving instructions and name and address of sender.

The sample should bear, either outside or inside the package, the name and address of the sender for identification. If more than one sample is sent in a parcel, they should be numbered or lettered, so as to correspond with the numbers, &c., in the letter of advice.

Soils.—Owing to the length of time required to carry out a satisfactory analysis of a soil, and the fact that there are a large number always waiting their turn, some delay is unavoidable in furnishing the result. If the results are required before carrying out any particular operation, farmers are advised to send in the samples about three weeks beforehand.

For the guidance of farmers in forwarding samples of soil the following directions are submitted:—

1. Dig holes in three or four places at fair distances apart to a depth of 18 inches or 2 feet. Clean out holes. Take a clean slice from each hole to the beginning of the subsoil, or to a depth of not more than 9 inches. Mix all well together, and of the mixture send a sample weighing 3 to 4 lb., including stones, fibres, and everything.
2. Send also a sample of the subsoil, 1 lb.
3. If the soil in different parts of the field is manifestly of different qualities, samples of each kind should be forwarded.
4. A rough sketch of the field, showing the spots where the samples have been taken, should be forwarded.
5. Forms of application for analyses of soil can be obtained from the Department.

The Chemist's technical report will be fully explained, and experiments in manuring, crops, and treatment will be suggested, based on the analysis regarded in the light of the detailed history submitted with it.

In forwarding samples, mark each package with the name of the sender, and if more than one sample is sent attach a distinguishing number to each, corresponding with the number in the letter and the sketch-plan.

Manures.—In forwarding samples of manure for analysis, great care should be taken to ensure that the sample sent represents a fair average of the bulk. In the case of a dispute between vendor and purchaser, the sample should be taken in the presence of someone representing the seller, or, in his absence, in the presence of a police officer. Three samples should be taken and sealed separately, one to be sent to the Department for analysis; the second handed over to the seller's representative or the police officer; and the third kept with seals intact for future reference.

A sample from ¼ to ½ lb., or even less, is sufficient for analysis, provided it has been properly sampled.

Plants should be cut close to the ground, the cut ends enveloped in sacking, and sent away immediately after packing. A box knocked together of loose boards, with interstices between the boards, is the best, as if packed in a tight box they are certain to sweat on a long journey. When sending plants or other perishable articles, such as milk, &c., for examination, a letter advising their despatch should be sent a few days previously, addressed to "The Chemist, Department of Agriculture, Sydney," so that their analysis may be undertaken immediately upon arrival. The samples should be sent direct to the Chemical Laboratory, 136 George-street.

Waters for irrigating purposes and for stock should be collected in perfectly clean glass-bottles. One ordinary quart-bottle will usually be sufficient. The bottle must be corked by a perfectly clean, well-fitted cork, and sealed. The bottle must, of course, be securely packed against breakage.

Wheat and Flour.—For examining the milling qualities of wheat a sample of 1½ lb. weight is required. It should be stated whether the sample has been previously cleaned or not, and to what extent it has been cleaned. The name of the grain, if known, should also be supplied, as well as any information available as to the district, class of soil, yield per acre, &c. The Department does not undertake to name wheat from the grain.

Flour.—A sample of about ¼ to ½ lb. is required for analysis.

The Romance of *Paspalum dilatatum*.

In the year 1890 a small packet of grass-seed named *Paspalum ovatum* was sent by Baron Von Müeller, Government Botanist of Victoria, to the Department of Agriculture in New South Wales, in the hope that the grass would succeed better under the sub-tropical conditions in this State than it had hitherto done in Victoria, where it had been tried with but partial success for several years.

The packet was divided amongst a number of men who used to experiment with new seeds, and about half an ounce was sent to Mr. Edwin Seccombe,

of Wollongbar, who was the keenest experimenter in the State, and had already done much to introduce new economic plants to the Richmond River district, so little known in those days.

In 1891 Mr. Seccombe, who was the only one that ever took any trouble with this grass, reported that he did not think much of it, as it was rather tussocky, but would continue to propagate it. On 19th May, 1892, he sent a specimen of a grass in full seed to be named, and said: "I have only four roots, which are now well stooled. They grow right through our dry summer and keep beautifully green." The grass was identified as *Paspalum dilatatum* by Mr. Fred. Turner, the Botanist of the Department at that time.

In the following year Mr. Seccombe had a small area covered with this grass, which is identical with the *Paspalum ovatum* that Baron von Müeller had obtained from South America, and which was well known under that name in many of the States of North America.

A year afterwards seed was being sold at £1 per lb. To-day there are 190,000 acres of land in this State planted with this grass along the whole of the coast, from the Tweed River to Eden. It is found in such widely different places as Glen Innes, in the New England district, with 30 inches annual rainfall, and at Pera Bore, beyond Bourke, where it grows excellently with 8 inches rainfall, supplemented by artesian water. Its real home, however, is on the coast between the Manning and Tweed Rivers, where it has doubled the productive value of the best land, and has quadrupled the grazing value of inferior land, which twenty years ago was useless for dairying. Mr. Seccombe reported in 1890 that there were many farms for sale on the Richmond River at from £2 to £5 an acre, and more sellers than buyers. To-day these farms are eagerly sought by buyers at from £20 to £40 an acre, and many tons of paspalum seed are now yearly exported at 5d. per lb.

Much of this is due to the wonderful properties of *Paspalum dilatatum* as a forage grass, but its very success gives cause for concern now, and the dairy farmers are beginning to realise that this grass alone is not a complete fodder for their milking cows, and that they must either conserve and encourage the white clover or any other leguminous plants which will grow in combination with it, or must cultivate cowpeas and other leguminous plants suitable for the district, to be fed with the paspalum, in order to make a complete ration.

It must be recognised that even the rich North Coast soils cannot continue indefinitely to produce such heavy crops of this prolific grass as they have done in the past without showing signs of exhaustion; but the greatest danger of this grass is its very dense and rank growth, which is apt to choke out the clover and other subsidiary herbage, and make a single crop for the cows' pasture, which can never be a well-balanced ration for dairy cattle.

It is intended to experiment in the direction of top-dressing paspalum paddocks with bone-dust and other phosphatic manures, both alone and in conjunction with lime and potash manures, to ascertain whether the feeding value of this valuable grass can be maintained and perhaps improved for another generation.—H. C. L. ANDERSON.

Cowpeas.

A. H. E. McDONALD,
Instructor in Agriculture, Hawkesbury Agricultural College.

THIS is an opportune time to draw the attention of farmers to this valuable summer legume.

In the famous Norfolk rotation, which is so largely adopted in England, clover occupies an important place, and probably has been largely responsible for the maintenance of the soil fertility of English farms through so many years of continuous cropping. Under the climatic conditions which prevail

Fig. 1.—A young crop of cowpeas, showing the method of planting in rows.

here in many places, the inclusion of clover in a system of rotation is not possible. As pointed out in the August number of this *Gazette*, there are, however, large areas in which it can be very successfully grown, and its advantages are ably indicated by Mr. Anderson. What clover is to the farmer in the cooler districts, so will cowpeas be where hotter and drier seasons prevail.

Although a fair amount has been written about this crop, many farmers are yet unaware of its value. In the United States, in the dry areas, cowpeas are extensively grown, both as a soil renovator and as a forage plant. In the cotton-growing States, they are largely depended upon for maintaining the

soil fertility. They are also used for hay, and are considered to be equal to lucerne. In the cane-growing districts of this State they are largely grown for the purpose of increasing the amount of humus in the soil, and to supply readily available plant food to the cane. In tropical Africa, the crop is grown extensively between the rows of palms in cocoanut plantations, for the same purpose of maintaining soil fertility. This shows that the cowpea has advantages which render it worthy of the attention of farmers who are concerned with the question of preserving or improving soil fertility, or those who require a forage crop.

Fig 4.—A single plant of the Black variety of cowpeas.

Nature of the Plant.

The cowpea has special qualities which must render the crop an attractive one to most farmers in this State. It is a gross feeder—that is, has great power of absorbing from refractory soils the substances which it requires for its growth. Few soils fail to yield up to it the plant food which it requires. Very poor, dry, sandy soils produce profitable crops, and heavy clays also return a good yield; in fact, very few crops possess the adaptability of cowpeas to the various kinds of soils.

Most of the legumes, particularly clover and peas, require special soil conditions; but cowpeas, although they certainly do best on good loamy soil, are not seriously affected by being grown on poor land, and the crop need not be neglected because the land happens to be poor. Its growth is particularly recommended, therefore, on those poor sandy soils,

Fig. 2.—Cowpeas—variety Poona—grown in sandy soil at the Hawkesbury Agricultural College; yield, 14 tons 6 cwt. per acre.

Fig. 3.—Black cowpeas, growing under similar conditions; yield 14 tons 8 cwt. per acre.

which stand so much in need of renovation by the incorporation of organic material rich in nitrogen. These soils are generally deficient in nitrogen, and cowpeas, it is well known, have, under certain conditions, the power of increasing the soil-content of this ingredient when their foliage and roots decay.

They have great drought-resistant powers. It has frequently happened at the Hawkesbury Agricultural College that in the hot, dry, summer months they grew luxuriantly, and produced heavy yields, when most other crops were stunted and ultimately failed. We are convinced that it is, when cared for properly, one of the most suitable crops for providing green feed wherever the rainfall is uncertain. It is also a valuable crop in warm districts where a heavy rainfall is experienced, as on the North Coast.

At the College, 13 tons of greenstuff per acre were obtained when the rainfall during the growing period was 11 inches, and the temperature frequently above 100° Fahr. A good average yield is 12 to 14 tons per acre.

Whilst the cowpea has the capability of thriving during dry weather, it will not stand cold. Comparatively high temperatures are necessary to its development, and where the summer is short, or where cold nights prevail, it is not a very satisfactory crop. It has, however, a wide varietal range, and in the cooler districts some of the quick maturing kinds prove successful.

Its Uses.

The chief uses of the crop are for green feed, grazing, hay, or soil renovation. The moisture-content of the green plant is very high, but when it is dried the food value of the hay is about equivalent to that of lucerne. According to Henry's "Feeds and Feeding," the digestible nutrients per 100 lb. of dry matter in each are:—

	Protein.	Carbohydrates.	Ether Extract.
Cowpea hay ...	10·8 lb.	38·6 lb.	1·1 lb.
Lucerne hay ...	11·0 „	39·6 „	1·2 „

These show that the feeding value of cowpea hay is remarkably similar to that of lucerne hay.

As a green feed it is very suitable for all classes of stock. It possesses the valuable qualification of not tainting milk, and we know of no cases of bloat or hoven having occurred amongst stock fed upon it.

Cowpea as a Soil Renovator.

As a soil renovator the crop deserves some consideration. The accompanying photographs show cowpeas grown in the College orchard to fit the ground for planting with young trees. As before-mentioned, they are capable of thriving on poor sandy soil, and these photographs show the growth on such land without the assistance of manure.

Many soils are so poor that they are incapable of producing the ordinary crops profitably, but cowpeas grown upon them, take up the inert plant food, and use it in forming their own roots, stems, and leaves; and when the crop is fed off or ploughed in, and decomposition takes place, this plant food is returned to the surface soil in a more available form for the use of less vigorous crops.

The fertilising ingredients in each 1,000 lb. of green crop are: -

Nitrogen, 2·7 lb. Phosphoric acid, 1·0 lb Potash, 3·1 lb.

According to these figures a good average crop of approximately 14 tons per acre would add 80 lb. nitrogen, 30 lb. phosphoric acid, and 90 lb. potash to the surface soil through the stems and leaves alone. To supply these amounts of plant food by manuring, it would be necessary to add about 400 lb. sulphate of ammonia, 175 lb. superphosphate, and 170 lb. sulphate of potash per acre. Not all this plant food can be used at once by the succeeding crop, but a portion can, and the remainder becomes available in succeeding years. In addition, the large amount of organic matter or humus added, much improves the capacity of the soil for holding moisture.

Through the intervention of minute organisms, which live in wart-like excrescences, called nodules, on their roots, cowpeas have the power of taking their nitrogen from the enormous store existing in the air. This nitrogen the cowpea utilises in its own growth, changing it into an organic form, and ultimately returning either the whole or a considerable portion to the soil, so changed that it becomes available for the use of crops such as maize and wheat, which have not the power of taking the free nitrogen from the atmosphere.

The organic matter added to the soil when the cowpea is grown as a renovating crop, is comparatively rich in those ingredients which serve as the nutriment of organisms. These ingredients act as a medium for the rapid development of the organisms, through the activity of which changes occur within the soil, rendering it more favourable for the support of plant life. Biological processes have a bearing upon the fertility of the soil to an extent which is not realised at present, and is only hinted at by the improvement noticeable in land after organic matter has been added. When their importance is more fully realised, greater attention will be paid to cowpeas and kindred plants.

Whilst cowpeas are sometimes ploughed in, this method is not the most profitable. By feeding them off, a considerable monetary return is obtained in the shape of beef, mutton, pork, milk, or wool, and at the same time the soil, through the dung and stubble, is left in a better condition than before the crop was grown.

Where it is desired to plough the whole crop in, as is sometimes the case in orchards, no great difficulty is encountered. The method adopted at the Hawkesbury Agricultural College is to roll the crop, disc twice, going the second time across the first; and then plough with a disc plough. This thoroughly cuts the crop up and incorporates it with the soil, and promotes rapid decomposition.

Cowpea Haymaking.

Cowpeas are rather difficult and expensive to cure into hay, and where lucerne can be raised, the utilisation of the crop in this way is not recommended. It can be more economically used for grazing or as green feed. Where, however, lucerne cannot be grown, a splendid class of hay can be

Fig. 5.—Disc harrowing a crop of cowpeas to prepare it for ploughing under.

Fig. 6.—Turning under a crop of cowpeas with a disc plough.

made from cowpeas for home use. The following method is advocated by the *Missouri Farmer* :—

Cowpeas differ from ordinary hay in having more moisture, and therefore in being more difficult to cure. Cowpeas are cut with a mower, and if not too thick, and the weather is favourable, they may be cured in the swath. If they are cut one evening they should be tedded the next, and if they have had full sunshine may be put up the following afternoon. Unlike timothy, they must have had at least eighteen hours of sunshine.

A better way is to rake into light windrows as soon as well wilted. If the peas are not too viny, a side delivery rake may be used to excellent advantage. After being partially cured they may be placed in tall narrow shocks to finish curing. Some use poles sharpened at both ends. These are forced into the ground and each forkful of hay put over it as though it were a paper-file. By this method the shock will be tall and narrow, curing and shedding water more readily than otherwise, and at the same time being quite stable. In stacking cowpeas the stack is ordinarily built in the usual way and topped out with timothy or redtop.

Sowing and Cultivation.

The seed should be sown in drills 2 feet 6 inches or 3 feet apart, according to the class of cultivator which is to be used subsequently in working between the rows. The sowing can be done with a maize drill fitted with a plate suited to the size of the cowpea seed, or by a wheat drill with some of the holes stopped to give the right distance between the rows. Not more than 10 lb. of seed are required per acre, and if the seeding is done carefully, 7 lb. will be sufficient. The seed should not be covered more than 3 inches deep. Broadcasting is sometimes practised, but it is extremely wasteful of seed, and the ground cannot be cultivated whilst the crop is growing.

A comparatively warm soil is required to ensure good germination, and sowing should not be done too early. In most districts sowing done in October and November is quite early enough. If the sowing is made too early the young plants will be deficient in vigour. After the crop has got a firm foothold, cultivation between the rows should be commenced, and in dry localities given constantly until the vines begin to cover the ground. It maintains a loose condition of the surface soil, thereby largely preventing evaporation.

Varieties.

The best varieties, where the summer is fairly long, are Black and Poona* ; while where the season is short, White is the best.

The Determination of Alkali in Arsenical Dip-fluid.†

L. COHEN, Chemist's Branch.

The determination of alkali in dip-fluid by direct titration against standard acid is complicated by the presence of tar and finely divided foreign matter from the hides of the cattle, which it is impossible to separate by filtration, and the black colour of which precludes the use of an indicator, except in the form of test paper.

If litmus paper is used, the carbon dioxide, and perhaps also the arsenious acid, indicate an acid reaction before all the sodium carbonate is neutralised;

* Clay-coloured also gave good results in Farmers' Experiment Plots last season. See *Gazette*, October, 1910, page 835.—Ed.

† Read before the Royal Society of N. S. Wales, June 1, 1910.

it consequently gives results a good deal too low. Besides this, the process of taking out a drop of the solution on a glass rod from time to time during titration, placing it on the paper, allowing it to remain a few seconds and then washing off, is a tedious one, and leaves much to be desired, even if the sample is first rendered acid, boiled to expel CO_2, and then titrated back.

The composition of the cattle-dip made according to the Departmental formula is :—

Arsenic (As_2O_3), 8 lb.	...	2 grams.
Washing soda, 10 lb. = Na_2CO_3 3·706 lb.	...	·92 „
Tar, ½ gall. = 5·25 lb.	...	1·31 „
Soap, 1 lb.	...	·25 „
Water, 400 gall.	...	1,000 c.c.

This solution has an alkalinity according to litmus paper of ·6 gram Na_2CO_3 per litre, although ·92 gram is present; and there is probably no actual excess of alkali over arsenic, since assuming the compound $Na_2O\ As_2O_3$ to be formed, we have ·92 gram sodium carbonate combining with 1·72 gram arsenious acid, leaving an excess of ·28 gram of the latter.

The figures obtained with litmus paper, though useful for comparative purposes, would appear to have no definite significance, and the following method is submitted as being both rapid and reasonably accurate.

It depends on the fact that a sufficient excess of acid flocculates both the tar and the fine silt particles, which are diffused through the dip-fluid when alkaline, this flocculent matter being then removed by filtration, and the filtrate, which will be found practically colourless on dilution, titrated against decinormal sodium hydrate with an indicator unaffected by CO_2 and As_2O_3.

To 50 c.c. dip-fluid in a small beaker, run in 5 c.c. normal sulphuric acid from a burette, stir, filter at once through dry paper, take 10 c.c. filtrate with a pipette, transfer to a beaker and dilute with about 100 c.c. water; the solution is now colourless. Add two drops methyl orange solution (cochineal is entirely unsuitable, being rapidly bleached by the arsenic) and titrate to neutrality with decinormal NaOH. The end reaction will be found perfectly sharp.

Calling n the number of c.c. decinormal NaOH used, and p the number of grams Na_2CO_3 per 100 c.c. of dip-fluid, then

$$p = \cdot 053 \times (10 - \frac{11}{10} n)$$

Six samples of dip-fluid were prepared containing varying quantities of arsenic and soda, and gave the following results by this method :—

Amount of Na_2CO_3 added in grams per 100 c.c.		Grams As_2O_3 added.		Grams Na_2CO_3 found.		After deducting ·004 for soap.
·092	...	2	...	·095	...	·091
·092	...	1	...	·095	...	·091
·150	...	2	...	·152	...	·148
·150	...	1	...	·152	...	·148
·050	...	2	...	·054	...	·050
·050	...	1	...	·054	...	·050

(The alkalinity of the ·025 gram soap was first determined namely :—·004 gram expressed as sodium carbonate.)

It will be seen that the amounts of soda found agree closely with the amounts added, so that the method is sufficiently accurate for practical purposes.

Artesian Irrigation.

Alkalinity and Acidity Problems.

R. S. SYMMONDS, Chemist's Branch.

PERA—where the oranges come from—is about 9 miles from Bourke, the terminus of the Great Western Railway, which is 508 miles from Sydney. Fourteen years ago an orchard was planned and planted at Pera, and a bore sunk to tap the artesian water, which is used for purposes of irrigation, &c. At the present time there are 25 acres under orange and lemon trees, the former predominating. The oranges are particularly healthy, and do not show the slightest sign of disease, so common to this fruit when grown near the coast. The Pera oranges have a world-wide reputation for both flavour and size, some of them realising fancy prices, such as 7½d. each, and they are sold to regular customers at 6d. each by the case. This practical manifestation may be regarded as more convincing evidence of the good flavour and quality of the fruit than the opinion of any expert, no matter how competent.

This orchard has been continuously irrigated by artesian water from Pera Bore No. 1. On comparing my analysis of this water (B) with the analysis of water from this bore made by Mr. J. C. H. Mingaye, fourteen years ago, (A), it will be seen that there is practically no variation in the mineral content of the water, except, perhaps, a slight reduction in the amount of potash. It will also be seen that the predominating alkaline ingredient in this water is carbonate of soda, which substance is the cause of most of the injury associated with the use of artesian water for growing crops.

ANALYSES of Artesian Water from Pera Bore No. 1.

Grains per Imperial Gallon.

Mark.	Sodium Carbonate. (Na_2CO_3)	Potassium Carbonate. (K_2CO_3)	Calcium Carbonate. ($CaCO_3$)	Magnesium Carbonate. ($MgCO_3$)	Sodium Chloride. (NaCl)	Ferric Oxide and Alumina. (Fe_2O_3 and Al_2O_3)	Silica. (SiO_2)	Total Solids, Grains per gallon.	Date.
A.	33·118	1·225	0·849	0·402	7·600	0·252	1·064	45·076	1896
B.	32·845	trace.	0·899	1·907	7·308	0·336	1·260	45·500	1910

Speaking generally concerning the fruit and trees, this water has been used to irrigate the orchard with very good results. This year, however, the trees on several patches have an unhealthy appearance. The leaves of both orange and lemon trees become a sickly yellow, and fall off, and in several instances complete defoliation of the trees has taken place, although the fruit does not appear to be injuriously affected. It is very interesting to note

Healthy Tree, Pera Bore Orchard.

Defoliated Tree, Pera Bore Orchard.

that the trees adjoining (of the same variety), within a few feet of the affected trees, have an exceptionally healthy and vigorous appearance.

The defoliation of these trees may be caused by :—

(1) Accumulation of alkali in the subsoil;

(2) Excess of water. Owing to the calcareous and friable nature of the soil on these affected patches, water percolates very freely from the furrows;

(3) The presence of a hard-pan, which prevents the escape downwards of the excess of water, in consequence of which the soil becomes waterlogged ; or

(4) Deficiency of nitrogen generally.

Nitrogen.

On referring to the tabulated results of analysis of soil from Pera Orchard (Table A), it will be seen that these soils are deficient in organic matter and nitrogen. The "volatile" in these soils is, of course, very largely combined water, mostly referable to ferric hydrate and colloidal clay The organic matter, having been dissolved by the carbonate of soda, has been washed out of the soil, in consequence of which the nitrogen content is low. The presence of diffusible colloids, and the resulting impervious condition of the soil, would cause the roots to suffer from lack of oxygen.

The presence of oxygen is necessary, not only for the production of nitrates, but also to preserve nitrogen in that form. If the conditions occurring in the soil are favourable to reduction, denitrification takes place. This destruction of nitrates has been attributed by some investigators simply to the action of reducing agents, particularly organic matter, but it should not occur to any great extent if the soil is properly aerated. The reduction of nitrates is, however, generally believed to be due partly, if not completely, to the action of anaerobic bacteria. The activity of the nitrifying ferments is probably greatly reduced when the supply of oxygen is diminished by the presence of diffusible colloids, which expand considerably when wet, and a point is soon reached at which their action ceases altogether. The conditions may then be regarded as favourable to anaerobic bacteria, which are usually present in the soil. It is known that many of these bacteria can reduce nitrates to nitrites, and even to nitrogen.

Whatever may be the true explanation of the cause of the defoliation of these trees, a bacteriological examination should be made to ascertain the nitrifying power of these soils, as it is quite possible, indeed very probable, that the application of small quantities of nitric or sulphuric acid to these alkaline soils would be the means of coagulating the diffusible colloids, thus forming compound particles and rendering the conditions favourable to aeration and nitrification. The following laboratory experiment may be regarded as an indication of the effect sulphuric acid would have on the Pera soil :—

Two glass tubes, each 24 inches long, were closed at the lower end with muslin ; they were then filled to a height of 14 inches with pulverised, air-dried "hard-pan," which had passed through a sieve containing 2,500 holes

to the square inch. One tube was filled to the top with distilled water, the

Indeed, the re-establishment of the penetration of water will prevent addi-

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Table A.

Analysis of Soils from Pera Bore Orchard.

Number	Distinguishing mark and depth.	Nature of Soil	Coarse gravel.	Fine gravel,	Sand	Clay.	Colour.	Reaction.	Water Capacity.	Capillary Power.	Moisture,	Volatile	Nitrogen,	Soluble in hot Hydrochloric Acid sp. gr. 1·1. Lime (CaO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).
			per cent	per cent.	per cent.	per cent			per cent.	inches.	per cent	per cent,	per cent.	per cent.	per cent.	per cent.
1	Virgin soil, surface to 6" deep	Loam. .	None	0·74	67·30	31 96	Red ..	Strongly acid	30 0	9 8	2 95	4 00	028 deficient .	·173 satisfactory	213 good	·070 fair.
2	Lucerne plot, surface to 6" deep ...	,, .	,,	0 74	64·30	34 96	,, ..	Very faintly alkaline ..	28 5	6·2	2·52	3 35	·040 ,,	200 ,, .	285 ,, .	·050 ,,
3	,, ,, 6" ,, .	,, ..	,,	0 80	64·30	34·90	,, .	,, ,,	32 0	9 8	2 55	4 35	049 ,, .	276 good ..	·272 ,, .	055 ,,
4	Plot A (affected) surface to 6" deep .	,, ..	,,	1 06	69·00	29·94	,,	Faintly alkaline	30·0	9 8	1·85	3 10	·028 ,, .	·360 ,, .	324 ,,	·154 satisfactory,
5	,, ,, 1' to 1' 6" deep .	,, .	,,	0·66	61·00	38·34	Light red	Alkaline	33 0	7 8	5·51	4 75	·028 ,, .,	1·275 excellent . .	·477 ,, .	·064 fair.
6	,, ,, 2' to 2' 6" deep . .	,, ..	0 86	1·06	70·00	28·08	Fawn ..	Strongly alkaline	26 0	11·0	4 65	5 00	·028 ,, .	5·236 calcareous	360 ,, .	·049 indifferent.
7	,, (unaffected) 6" to 12" deep . .	,, ...	None	0·94	65 10	33·96	Red ..	Faintly alkaline ..	29 0	3·0	3 68	3·00	028 ,, .	·306 good .	·369 ,, .	·051 fair.
8	,, ,, 12" to 1' 6" deep ...	,, ...	,,	0 94	58 00	41·06	,, .	,, ...	33 0	2·0	4·50	3·85	·021 ,, .	1·365 excellent ...	·427 ,, .	·080 ,,
9	,, ,, 2' to 2' 6" deep .	,, ...	5·20	4 00	59·00	31·80	Fawn ..	Alkaline	27 0	9 0	5·40	5·90	·021 ,, ...	8·045 calcareous .	·330 ,,	·061 ,,
0	Plot C (affected) surface to 6" deep	,, .	None	1·20	67·70	31 10	Red .	Very faintly alkaline .	32·5	8 0	2·65	3·75	·056 fair	·480 good ..	·345 ,, .	109 satisfactory.
11	,, ,, 12" to 1' 6" deep ...	,, ..	,,	1·06	64·30	34·64	,, ..	Faintly alkaline . .	27 0	4 0	3·45	3 50	·056 ,, ..	·788 very good	338 ,,	·071 fair.
12	,, ,, 2' to 2' 6" deep .	,, .	0 74	2·20	53·00	44 06	Fawn ..	Alkaline	38·0	8·0	4·15	6 35	014 deficient .	13 095 calcareous.	·213 ,, .	061 ,,
13	Plot D (affected) surface to 6" deep .	,, ...	None	0·50	61·00	38·20	Light red	,, ...	34·0	8 0	3·25	5·40	028 ,, .	5·100 ,, ..	345 ,, ..	·123 satisfactory.
14	,, ,, 12" to 1' 6" deep .	,, ..	2 14	0 86	53·70	43 30	Fawn ..	,, ...	36·0	8 0	4 85	7·10	·021 ,, .	8·795 ,,	396 ,,	·074 fair.
15	,, ,, 2' 6" to 3' deep .	,, ..	1·34	1·20	42·00	55·46	,, .	,, ...	33 0	6 0	5 70	6·65	007 ,,	8·895 ,,	·322 ,,	058 ,,
16	,, (unaffected) surface to 6" deep ..	,, ..	0·20	1 00	65 30	33·50	Red .	Faintly alkaline ...	23 0	5 0	1 93	2·77	028 ,, ..	·264 good ...	241 ,,	·067 ,,
17	Tweed Heads, surface to 8" deep ...	Friable clay.	2 40	5·80	7 00	84 80	,, . .	Very strongly acid .	61 0	5·7	8 40	18 99	·302 good .	162 satisfactory	·029 bad	·102 satisfactory.

Table B.

Analysis of Soils from Moree Irrigation Farm.

Number.	Distinguishing mark and depth	Nature of Soil.	Coarse gravel.	Fine gravel.	Sand.	Clay.	Colour	Reaction.	Water Capacity.	Capillary Power.	Moisture.	Volatile	Nitrogen	Soluble in hot Hydrochloric Acid sp gr 1·1 Lime (CaO).	Potash (K_2O)	Phosphoric Acid (P_2O_5)	Soda (Na_2O)
			per cent.	per cent	per cent.	per cent.			per cent.	inches.	per cent.	per cent,	per cent.	per cent.	per cent.	per cent.	per cent.
1	Virgin, surface to 6" deep	Clay ...	0·60	11 00	18 00	70 40	Black .	Very faintly alkaline ...	54 0 good ...	3·2 fair ..	7·88	4·42	·063 fair ..	·715 good ...	·286 good .	·045 indifferent.	·057
2	,, 6" to 12" deep	,, ..	0·53	10·54	17 00	71·93	,, .	,, ,, ...	55 0 ,, ...	2·8 poor ...	8 51	4·44	·042 deficient . .	·845 ,, ...	·274 ,, ..	·058 fair .	·158
3	,, 12" to 18" deep	,, ...	0·60	10·00	17·00	72·40	,, .	,, ,, ..	57 0 ,, .	1·7 very poor ...	8 20	4·42	·028 ,, .	·777 ,, ...	·272 ,,	·043 indifferent.	·127
4	,, 18" to 24" deep	,, . .	0 60	10·00	16 00	73·40	,, .	,, ,, ...	53·0 ,, ..	1·2 ,, ...	8·42	4·47	....	680 ,, ..	·285 ,, .	·048 ,, ..	·179
5	,, 24" to 30" deep	,, ...	0·86	10·00	14·00	75·14	,, ..	,, ,, ...	55 0 ,, . .	1·0 ,, ...	8·45	4·55	. .. .	·700 ,, ...	·324 ,, ..	·045 ,, ..	·181
6	,, 30" to 36" deep	,, ...	09·4	8·40	12·70	77 96	,, .	,, ,, ..	56 0 ,, ..	1·0 ,, ...	8·02	4·62	.. ..	1·000 ,, ...	·324 ,, .	·065 fair .	275
7	Irrigated, surface to 6" deep . .	,, ...	0 53	12·27	17·70	69·50	,,	Alkaline	65 0 high ...	0·5 ,, .	6·85	5 94	·028 deficient .	·703 ,, .	·353 ,, .	·052 ,, .	·282
8	,, 6" to 12" deep	,, ...	0 73	12·13	13·30	73·84	,, .	,, ...	67·0 very high ..	0·5 ,, ...	8·05	6 02	·028 ,, ..	·758 ,, ..	·318 ,, .	058 ,,	·290
9	,, 12" to 18" deep	,, ...	1·13	13·67	14·00	71·20	,, .	Faintly alkaline	73 0 ,, ...	0·5 ,, ...	8 10	6·18	·014 ,, ..	·695 ,, ...	·318 ,, .	·045 indifferent.	·250
10	,, 18" to 24" deep	,, ..	1·00	10·07	12·30	76 63	,, .	Very faintly alkaline ...	70·0 ,, ..	0·5 ,, ...	7·40	6·35	....	·843 ,,	·320 ,,	·067 fair ..	·246
11	,, 24" to 30" deep	,, . .	0·60	9·66	12·00	77·74	,, .	,, ,, ...	66·0 ,, ...	0·5 ,, ...	8·27	6 08	....	·650 ,, . .	·244 ,, .	·051 ,, ..	·352
12	,, 30" to 36" deep	,, ...	0 60	9 46	12·00	77·94	,,	,, ,, ...	66·0 ,, ..	0·6 ,, ...	9·00	6 33	....	·642 ,,	·247 ,, ..	·062 ,, .	·355

to the square inch. One tube was filled to the top with distilled water, the other with water acidulated with sulphuric acid. The distilled water penetrated this soil one (1) inch in twenty-four hours; whereas the acidulated water penetrated eleven (11) inches in one hour. The water containing the acid, after passing through the soil, was *alkaline* to litmus paper, which proves that an impervious soil becomes pervious to water when sulphates are present. In other words, the diffusible colloids are coagulated in an alkaline soil by the application of sulphuric acid in a quantity considerably less than would be required for complete neutralisation of the alkali.

Hilgard, the authority on alkali soils, says:—

> In the presence of much carbonate of soda, *nitrates* are usually scarce or altogether absent; while owing to the action of the alkaline solution upon the humus, ammonia salts, or even free ammonia, may be present, so as to be perceptible to the senses by its odour in hot sunshine. But in the case of "white alkali," more especially of the sulphate in moderate amounts, nitrification is exceedingly active, and nitrates may sometimes rise to as much as 20 per cent. of the soluble salts.

As far as we know, the salt of sodium least injurious to ordinary vegetation, is the sulphate called Glauber's salt, which ordinarily forms the chief ingredient of "white alkali," and which is well known to be much less injurious to crops and soil than the "black alkali" which contains carbonate of soda. Hilgard also found that potassium chloride acts favourable up to ·3 per cent., but at ·8 per cent. suppresses nitrification. Earthy and alkaline sulphates, on the contrary, seem to act favourably throughout, at least up to ·5 per cent. This is especially true of gypsum, which accelerates the process of nitrification more than any other substance known. Taking the effect of gypsum as the maximum, he found that, other things being equal, the amounts of nitrates formed were as shown in the following table, the effect of gypsum being taken as 100:—

Gypsum	100·0
Sodium sulphate	47·9
Potassium sulphate...	35·8
Calcium carbonate	13·3
Magnesium carbonate	12·5

The above estimates were markedly confirmed by Hilgard, while examining the alkali soils of California. In these, nitrates exist most abundantly when the salts contained in the soil are mainly sulphates; while wherever common salt and sodium carbonate are present in considerable amounts, the amount of nitrate found is notably less. It is also well known that in lands near the sea, owing to the presence of sodium chloride, which is always an unwelcome addition to soil, nitrates are usually present in traces only.

The presence of chlorides in the subsoil of the affected patches, to an extent equalling ·116 per cent. of sodium chloride, is probably a contributing cause of defoliation, and partly denitrification. The presence of sulphates in some of our artesian waters probably explains why some agriculturists are more successful than others when using this water for growing crops, and I am of the opinion that the direct application of sulphuric acid to the soil, where alkaline artesian water is used, would be followed with good results.

Indeed, the re-establishment of the penetration of water will prevent additional induration, and if only accomplished locally, as around the fruit trees in the orchard, the colloids in the hard-pan should gradually coagulate, and form compound particles. The presence of sulphates would also prevent the humus going into solution, which is a very desirable detail. The open friable condition of soil undoubtedly favours the multiplication of aerobic bacteria; indeed the chemical processes occurring in the soil are very closely associated with microscopic life. This is especially the case with respect to the nitrogen required for plant-food, in consequence of which an examination of soil cannot be intelligently or usefully conducted without the collaboration of a microbiologist.

Hard-pan.

A hard, impervious hard-pan, which will not readily yield to plough, pick, or crowbar, is found at varying depths from 6 inches to 2 feet. Its presence at Pera is easily ascertained after rain, by means of a sounding rod or crowbar.

Four days before these samples were taken, 160 points of rain fell on this land. The larger portion of the surface 6 inches of soil, owing to the presence of hard-pan, retained practically all the water, and was like so much slush. Several trenches were dug to a depth of 2 feet 6 inches, in order to ascertain the depth to which the water had penetrated; in each case it was found to have penetrated only 6 inches. The greater part of the water would thus be lost by evaporation. Between the trees on the porous friable patches, where the land is ploughed, and furrows are made to convey the irrigating water, the soil shows signs of clogging, as the rain water is inclined to remain on the surface in puddles. This is, probably, owing to the formation of a plough-sole, a result of the practice of ploughing to the same depth for many consecutive years. The consolidated layer thus created by the action of the plough acts precisely like a natural hard-pan, and is sometimes the cause of the formation of a cemented subsoil crust, similar in action to the hard-pan referred to above. Where the cultivator is used instead of the plough, the soil does not show any signs of clogging on these patches.

Calcareous Sub-strata.

Hilgard, when referring to the cause of the defoliation of fruit trees, says:—

> Among the causes of failure occasionally found in the case of the "going-back" of orchards, is the occurrence of strongly calcareous or marly sub-strata, at depths which, in the humid region, would not be reached by the roots, but in the course of a few years are inevitably penetrated by the roots of trees in the arid region. Then there appears a stunting of growth, and sometimes a yellowing of leaves, due to the excessive calcareousness at the depth of 4 to 5 feet, and which tends to seriously disturb the nutrition and general functions of many plants, and to produce a suppression or diminution of the formation of chlorophyll and starch.

On referring to Table A, it will be seen that the subsoil of this orchard, at a depth of 2 feet 6 inches, contains as much as 13·095 per cent. lime (CaO), which is equal to 23·388 per cent. carbonate of lime. It will also be noticed that the surface soil (No. 13) of the badly affected patch contains over 5 per cent. of lime (CaO).

Colloidal Constituent of Soil and Acidity.

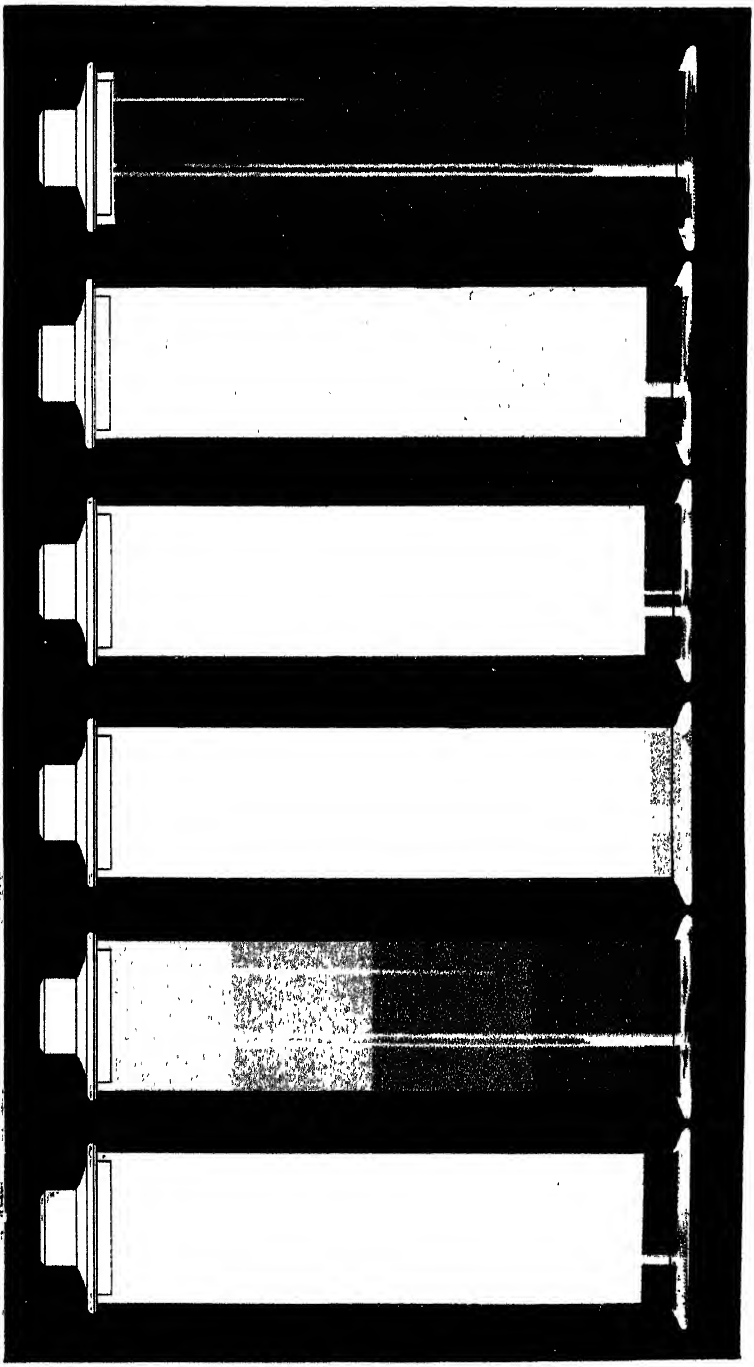
Having personally carried out about 1,000 analyses—chemical and physical —of soils from various localities in New South Wales, I find that 85 per cent. of those soils gave an acid reaction to litmus paper, while the balance of 15 per cent. were either neutral or alkaline to litmus paper. The alkalinity in some instances is undoubtedly due to the presence of a fairly large amount of lime, which possesses the power of coagulating the diffusible constituent of soil, and thereby forming compound particles, which then lose their jelly-like properties. The soil then becomes friable and pervious to air and water. A few of the soils which gave an alkaline reaction to litmus paper owe their alkalinity to the continued application of alkaline artesian water. The soil at Pera Bore orchard was originally acid and friable; after being watered for a few years with bore-water this soil became alkaline, and practically impervious to air and water. The carbonate of soda contained in the water neutralised the natural acidity, dissolved out the humus (organic matter), broke down the crumb-like structure of the soil, and transformed the coagulated colloidal constituent into a jelly-like substance readily diffusible in water. The diffusible colloids thus produced, when wet, expand enormously, and completely block up the interstices in the soil, which then presents considerable resistance to the passage of air and water. The light loam at Pera Farm, after a few years' treatment with bore-water, runs together when wet like mortar, and does not shrink or crack on drying like the black clay soils at Moree and Coonamble, but sets like cement and becomes very hard, rendering ordinary methods of cultivation unprofitable. The contraction or shrinkage of the Pera soils from a wet to an air-dry condition is practically nothing; but the shrinkage of the black clay soils of Coonamble and Moree is from 12 to 20 per cent.

The Pera soils, when saturated with water, may be regarded as having been reduced to a condition of ultimate particles in jelly. The conversion of the ultimate into compound particles will not take place in a dry soil nor in a very wet one. The soil is in a favourable condition to form compound particles when it is rather less than half saturated with water. This, then, is the time to apply acid to the soil for the purpose of coagulating the colloids; the formation of compound particles would then be brought about by the contraction of the mass.

The Pera soil, on drying after a flooding, is like a macadamised road; the black clay soils, on drying, shrink and crack in every direction. This fact is possibly one of the reasons why artesian water can be successfully used for purposes of agriculture on these clay soils. This excessive shrinking and cracking of clay soils, in my opinion, is the cause of plants wilting, though the moisture content be greater than that of sandy soils, in which plants do not wilt. The clay, on shrinking, presses very tightly around the fine roots, holding them fast; while the clay, on cracking, tears the roots asunder, thus cutting off the water supply.

Reference was made in a previous paper (see *Agricultural Gazette*, December, 1909) to the peculiarity possessed by diffusible colloids of

Fig. 1. Fig. 2. Fig. 3. Fig 4. Fig. 5 Fig. 6.



ARTESIAN IRRIGATION: ALKALINITY AND ACIDITY PROBLEMS.
PLATE I.

arranging themselves into different layers when shaken up in water and allowed to stand undisturbed. Careful observation induces me to put forward the following explanation of this phenomenon: The colloidal clay and iron in these alkaline soils appear to be in varying stages of hydration, and excessive hydration is the cause of diffusion. Each layer represents a definite stage of hydration, holds a different proportion of water very feebly, and has different properties so far as its power to combine with water is concerned.

A portion of the colloid clay and iron from a Coonamble soil (irrigated with bore-water), after standing undisturbed in water for eighteen months, appears to be completely in solution [see Fig. 10]. This pseudo solution, by transmitted light, has the appearance of a clear oil; by reflected light, it has the appearance of a brown-coloured mineral oil, and the same peculiar fluorescence of such oils, with a well-defined purple colour on the surface. The colloid clay and iron are immediately coagulated and precipitated when acidified with nitric acid. Precipitation does not appear to be due to chemical combination with the reagent, as the latter remains in solution, and the precipitated clay and iron can be re-diffused in distilled water. It would, therefore, appear that in the presence of acid substances these colloids lose their power of diffusion and expansion in water, and it is quite possible that one of the chief functions of the acid substances in the soil is the coagulation of colloids, which results in the formation of compound particles and the production of the friable condition of the soil so essential to successful agriculture.

From data obtained during the examination of soils which have been irrigated by alkaline water, it would appear that the colloidal constituent of soil and clay may be present in a diffusible condition (hydrosol), or it may be present in a coagulated condition (hydrogel). Assuming that it is present in a diffusible condition, the soil or clay will be impervious to water; if it is present in a coagulated condition, the soil or clay, if not puddled, will be pervious to water. In other words, if clay reacts alkaline to litmus paper (provided the alkalinity is not due to the presence of lime), it will be impervious to water; but, if the clay reacts acid to litmus paper, it may be inferred that the clay is in a condition favourable to the penetration and percolation of water. This information should not only be interesting but very useful to engineers and others when selecting clays for the construction of dams which are intended to be secure against the percolation of water.

Cylinder Test.

Fifty grammes of air-dried fine soil from each sample collected at Pera, were briskly shaken for a few minutes in a cylinder containing 3 litres of water, and allowed to stand undisturbed for thirty days. Plate I illustrates this test. Fig. 1 shows the total absence of diffusible colloids in the virgin acid soil, the whole of the sample having completely settled, leaving the supernatant water perfectly clear. Fig. 2 shows clearly the large amount of

diffusible colloid produced in this soil by artesian water; four well defined layers will be noticed. Fig. 3 shows the result of shaking up fifty grammes of calcareous subsoil in the cylinder of water. It will be seen that there is practically no diffusion of clay or iron in the subsoils comparatively rich in carbonate of lime.

Soil sample No. 17 is a very strongly acid, friable clay, of red colour, from Tweed Heads. Dr. Jensen, who collected and analysed this sample, says:—

This soil represents the surface 8 inches, and was taken in a softwood and vine scrub near the Tweed Heads cemetery. The geological formation of the country, of which it is typical, is basalt and basic andesite. The subsoil is not deep, similar to the surface soil, but paler in colour, somewhat yellowish, and very stony.

The soil sample is of a red colour and very strongly acid; it is typical of the good volcanic sugar-cane lands of the Tweed River. Mechanically it is a friable clay. The water capacity is good, but when dry the soil resists wetting for a considerable time. Its capillary power is good.

Chemically this soil is a somewhat leached humus soil, the hygroscopic water forming 8·4 per cent., and volatile 19 per cent. of the weight. Leaching by the aid of organic acids formed from decaying vegetation probably accounts for the poverty in lime and potash. The lime percentage is low for a basalt soil, and the potash is very bad. Potash would, in any case, not be abundant in a basaltic soil, since the rock from which it is formed is very poor in that ingredient, but in this case it is lower than usual. The heavy scrub probably extracts the potash very rapidly, while leaching also plays its part in removing that compound. Bush fires never occur in these moist scrub lands, so no restoration of potash can take place in this way.

Nevertheless, the amount of immediately available mineral plant food is probably high, since basalt is a rock which weathers rapidly under the conditions existing in the scrubs.

In order to ascertain the effect which carbonate of soda would have on this soil, the following tests were made:—Fifty grammes of an air-dried sample of the fine soil were shaken up in water and allowed to stand undisturbed for three months (see Fig. 4). The soil quickly settled, leaving the supernatant water clear, which shows that the colloidal constituent of this soil, owing to its acid reaction, is in a coagulated condition.

The cylinder (Fig. 5) contains 50 grammes of the same sample of soil, to which have been added 30 grains of carbonate of soda; the cylinder was then filled with cold water, shaken vigorously, and allowed to stand for three months. In this case only the organic matter present in this soil has been dissolved.

Cylinder No. 6 contains the same amount of soil and carbonate of soda as cylinder No. 5, but in this case the soil and soda were mixed and boiled for ten minutes, transferred to the cylinder of water, shaken briskly, and allowed to stand undisturbed for three months.

It will be seen that nearly all the clay and iron of this soil, after boiling with soda, is in a diffusible condition. This may be regarded as an illustration of the influence of temperature on the velocity of chemical change. The law that the velocity of chemical processes—*i.e.*, the ratio of the amount transformed to the time required—rapidly increases with rising temperature, is quite universal, and is valid for chemical processes of all kinds. We have, further, no ground for supposing that any chemical change which takes place

FIG. 7. FIG. 8. FIG 9. FIG. 10.

ARTESIAN IRRIGATION: ALKALINITY AND ACIDITY PROBLEMS.

at a higher temperature cannot take place at a lower. If we do not note any transformation, it may be because it takes place too slowly for our observation. Ostwald says :—

By time measurements of the progress of many chemical reactions, the approximate rule has been obtained that the velocity of chemical reaction is, on an average, doubled by a rise of 10 degrees in the temperature—that is to say, if a reaction at a given temperature requires, say, a quarter of an hour to reach a certain point, at a temperature 10 degrees higher it would require only seven and a half minutes, and at one 10 degrees lower thirty minutes. If the temperature is lowered 100 degress, a $2^{10} = 1{,}024$ times longer period is necessary, or in our own example, about eleven days. On descending a further 50 degrees, or, on the whole, only the moderate amount of 150 degrees, it would be a year before the reaction had proceeded as far as it had done in a quarter of an hour at the higher temperature.

This very probably explains why almost any of the alkaline artesian waters can be successfully used on the soil for two or three years, and the facts illustrated above indicate an important direction for investigation.

The coloured plates are the work of Mr. E. M. Grosse, of the Government Printing Office. With the exception of Fig. 10, which represents the colour of this pseudo solution when viewed by diffused transmitted light, the various shades of colour representing the contents of these cylinders are as they appeared by reflected light.

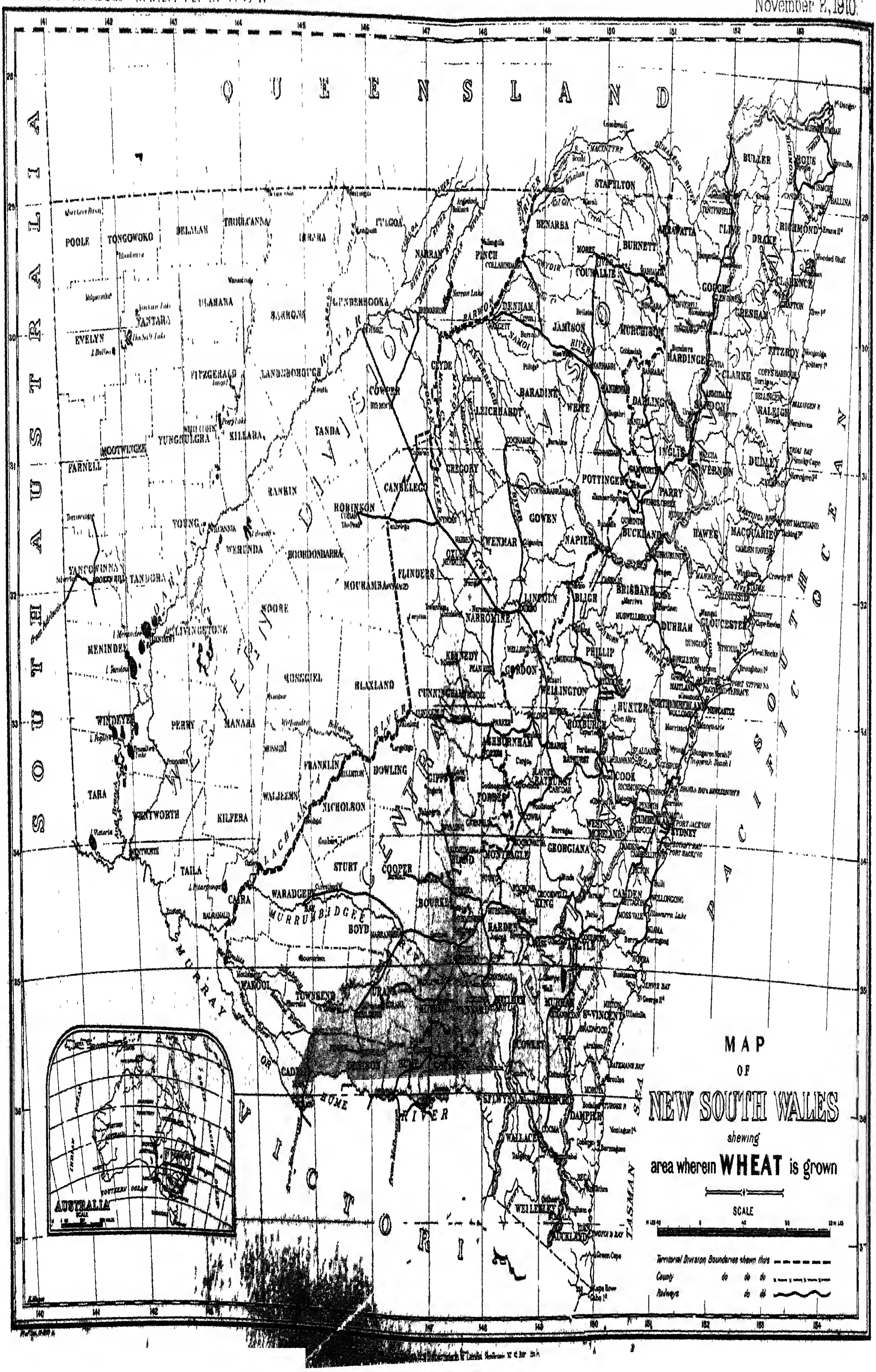
Moree Black-clay Soil.

The heavy clay soils of Moree, which have been irrigated by bore-water, instead of contracting into a hard mass on drying, on the contrary resolve into a mass of crumbs, thus producing excellent tilth. This occurs even though the land may have been ploughed wet, and of course is a great advantage. When speaking of the Moree soil under irrigation by artesian water, Mr. A. E. Darvall says :—

For irrigation, the black-clay soil of the North-western Plains, with its easy gradients, is ideal, and with a little care forage and grain crops can be grown to perfection in the driest seasons. The stiffness of the soil obviates the necessity of putting in cement or wooden distributing ditches, which are always an expensive item, both as regards the initial cost and their maintenance afterwards. The irrigation furrows do not require constant watching to prevent them from breaking as they do in lighter soils; and the habit the clay has of cracking as it dries makes it easy to irrigate crops such as wheat and oats when they are too high to allow a man to get in amongst them, the cracks leading the water naturally to the driest places and to the roots of the plants, where it is most required.

The Moree soils apparently possess the distinguishing characteristic of the American "black adobe" and "buck-shot" soils, and only require water to render them extremely fertile. On referring to Table B, it will be seen that the soda content of soil from the Moree Irrigation Farm, where artesian water has been used for irrigation, is much higher than in the virgin soil. It will also be noticed that the nitrogen content and capillary power have been considerably reduced.

While examining soil from this Farm in the laboratory, I noticed that the diffusible colloids present in this soil were of a light greyish-white colour (see Fig. 7); but the colloids present in the red and brown coloured soils from Coonamble and Pera were of a distinctly red colour (see Fig. 8). On making an analysis of each of these colloids, I was a little surprised to find that they contained practically the same amount of iron, viz., 13 per cent. (Fe_2O_3).


QUEENSLAND
SOUTH AUSTRALIA
VICTORIA
SOUTH PACIFIC OCEAN
TASMAN SEA
MAP
OF
NEW SOUTH WALES
shewing
area wherein WHEAT is grown
SCALE
Territorial Division Boundaries shewn thus
County do do do
Railways do do
AUSTRALIA
SYDNEY
NEWCASTLE
MURRUMBIDGEE
MURRAY
LACHLAN
DARLING
BARWON
HUME
RIVER

It then occurred to me that the iron present in the white colloids of the black soil is in the ferrous condition, and that the iron present in the colloids of the red soil is in the ferric condition. Owing to the presence of organic matter in soils, it is a very difficult matter to determine accurately the amount of ferrous iron present. These black-clay soils are well known to be very fertile, and as some believe the presence of iron in the ferrous condition is a cause of infertility, I carried out the following experiment, which may be regarded as proof that iron present in the light coloured colloids of the black soil is in the ferrous condition :—

Sulphuretted hydrogen gas was allowed to bubble through a solution containing red colloids from soils collected at Pera and Coonamble. The colloids gradually changed from a red colour to a brown and finally black, due probably to the reduction and formation of sulphide of iron and other sulphides. On coagulating the colloids with a drop of sulphuric acid, which cleared the solution, I found that the iron had been reduced to the ferrous condition, and that the colloid became white in colour, similar to that observed in the black soil (see Fig. 9). This suggests that iron in a ferrous condition is not so injurious as it is thought to be by some; indeed it may be regarded as evidence the other way, and should be of interest to those studying soil bacteria.

In conclusion, my opinion as to the cause of defoliation may be briefly summarised thus :—The defoliation of the fruit-trees at Pera Orchard is due to insufficient aeration and denitrification of the soil, which condition has been brought about by the action of the alkali contained in the water used for irrigation. The alkali (carbonate of soda) neutralised the natural acidity, dissolved out the humus (organic matter), broke down the crumb-like structure, and reduced the soil to a condition of ultimate particles in jelly, which on drying becomes a hard compact mass, impervious to air and water.

The various points raised and suggestions made in this paper may be regarded as constituting a scheme for experimental work in the direction indicated; and whether future investigation confirms them all or not, the results will be of value.

Wheat Map of New South Wales.

With this issue we publish a map, prepared in the Department, showing roughly the area wherein wheat is grown to any great extent. Of course there are isolated localities both east and west of the yellow belt which are devoted to the growth of wheat, chiefly for hay or green feed; but the area shown is approximately the present recognised wheat belt. It will be interesting to compare this map with the Annual Average Rainfall Map, recently issued by the Commonwealth Weather Bureau. The present Wheat Map will also serve as a base for observing the advance in wheat-growing which will undoubtedly result during the next decade from the development of dry-farming.

Harness, Harness Fitting and Repairing.

A. H. E. McDONALD,
Instructor in Agriculture, Hawkesbury Agricultural College.

THE interest evinced in this branch of the educational work of the College, by both the regular students and the farmers attending the Winter Schools, is evidence enough that the agriculturists of the State are keenly alive to the importance of the subject. Indeed, when one considers the place occupied by harness in farming operations, as the agent for the transmission of the chief power used, it is difficult to imagine any branch of work of which it is more essential that farmers should possess a considerable knowledge.

In the compilation of this little series of articles I have received, and desire to fully acknowledge, great assistance from Messrs. Geo. Cobb, Farm Foreman, and H. Collins, Saddler, of the College. I have endeavoured to fit into place the information supplied by these officers; and it is hoped that, whilst the series will undoubtedly contain much that is known to many *Gazette* readers, the hints furnished will tend to greater efficiency and more humane treatment of horseflesh in many parts of the State.

Much depends upon the tractive power of the horse, and its effective utilisation necessitates the adoption of harness which will not in any degree tend to depreciate the value of his strength. The price of all horses, whether used for light or heavy draught, is extremely high, and, even apart from considerations of comfort, it does not pay owners to have their horses laid by through injuries contracted in the course of their work. The harness is necessary to enable the animal to exert his strength efficiently, and in selecting the harness it must be remembered that, while securing this, it must not cause more than the unavoidable minimum of discomfort. No horse put in harness should suffer any inconvenience except that arising from fatigue. Unfortunately, however, through lack of knowledge of the proper adjustment of harness, many horses do suffer considerable pain whilst at work. This gradually leads up to temporary incapacitation, and in some cases to permanent injuries such as fistulous withers, &c.

Many vices—for example, jibbing and bolting—have their origin in badly-fitting harness. When the horse is compelled to work in an unsuitable collar, its undue pressure on any part of the shoulder causes chafing and soreness, and the horse naturally recoils from what causes him agony. Ultimately the best-tempered beast becomes vicious and uncontrollable, through nothing but culpable ignorance on the part of his driver.

Every horse differs in size and shape, and, to fit him properly, it is necessary to use much care. It is not sufficient to depend upon the saddler to fit horses with their harness. The owner must know the use and proper adjustment of every part. Wrung shoulders frequently occur through leaving the selection to the saddler, who, rather than go to the trouble of obtaining a proper

collar for a difficultly-suited horse, chooses the nearest fit in his ready-made stock, and justifies his choice by the contention that the collar will soon adjust itself to the shape of the shoulder. If it is not a good fit in the first instance, it will never become so, and in the so-called self-adjustment it is quite possible that the horse will be permanently injured.

PLOUGH HARNESS.

This is the simplest form of harness, and consists merely of winkers, collar and hames, backband, and chains.

The Winkers.

Winkers are almost exclusively used as the headgear for horses doing heavy draught work. Open bridles are seldom used, as the horse, unless he is particularly willing, develops a cunning habit of shirking his work.

The eye-pieces of the winkers should project outwards from the eyes at the front, but must fit closely behind. The bit should be sufficiently strong to stand the work required of it, but should not be cumbersome. An ordinary snaffle-bit is suitable for most work. It should be fitted to the winkers so that it lies within a quarter of an inch of the bars of the lips—that is, the junction of the upper and lower lips. If drawn up tightly, the bit produces chapped lips, and is responsible for much pain; while if it is too low, it is also likely to cause inconvenience, and may be pushed out of the mouth.

On the winkers for draught horses it is an advantage to have the bit attached on one side with a short, light strap, so that it can be easily and quickly slipped out of the mouth if desired, without removing the winkers.

Bearing-reins are required to prevent the horse cropping at the grass as he moves along. When at work they are buckled over the tops of the hames, sufficiently tight to allow the freedom of the ordinary carriage of the head. Where a pair is used with a pole, the bearing-reins prevent the horses lowering their heads and so catching their headgear on the pole.

The Collar.

This is the most important part, as it is upon it the horse exerts his strength, and it also comes most in contact with the body. Collars for heavy horses are either simply curved or rounded at the lower part, or are piped to allow of freer action of the windpipe. The piped collars are the more satisfactory, especially on horses with prominent windpipes.

Scrupulous care should be exercised in the selection of the collar. Those who have suffered the excruciating pain caused by tight boots or chafed heels can realise the torture that horses, which are almost as keenly sensitive as men, are called upon to endure when their harness fits badly. Two extremes must be avoided. The collar should not fit too tightly on the whole or any one part of the shoulder, and it should not be too large. Chafing is caused principally by large fittings rubbing over a part, just as large boots chafe the feet.

The collar should fit neatly and firmly over the whole of the shoulder. This can easily be seen by buckling the collar tightly, and gently moving it up and down, and backwards and forwards, until every part has been inspected.

The chief seat of injury is the point of the shoulder. This is the most prominent part, and when the collar fits badly most of the pressure is taken by it, instead of being distributed over the full surface.

Injuries frequently occur at the withers. Such usually happen when the collars fit badly, or when the horses have to carry weight upon their necks, as they have in pole work. It is a form of injury which is particularly dangerous, as it may lead to an incurable fistula. Some horses' necks are very thick at the top, and the ordinary collars are not wide enough. It is necessary to get them specially made for such horses.

The shape of the shoulder changes considerably when the horse is put to fast work, and the fit of the collar then must be noticed. It can be seen by examining the collar and surface of the shoulder immediately he is taken out after work.

Nothing is so liable to cause injury to the shoulders and to prevent the horse exerting his full strength as a flat collar. A well-fitting collar, when new, is roundly stuffed, and fits closely over the shoulder. It possesses a springiness which makes it comfortable, but after a little use the stuffing is compressed, and the inner surface becomes flat. All collars, after they have been used for a time, should be restuffed.

Collars are lined with serge or leather. The latter material is cooler and easier to keep clean, but is liable to crack. This is a discouragement to its use in all but light harness.

Sweat and dirt accumulate on the surface, and should be regularly removed. If allowed to remain, a hard condition is produced, which causes chafing.

Young or fat horses have tender shoulders, and are liable to chafe, especially in the summer, and they should be carefully used until accustomed to work. Whilst a horse is in work a careful watch must be kept for indications of soreness. Immediately he is taken from his work the harness should be removed and a careful examination made for undue heating in any particular part. Bathing the shoulders with salt and water hardens the skin and renders it less susceptible to injury.

Where galls are already existent on the shoulders, it is often a difficult matter to adjust the collar so that the horse can continue his work. The best method of surmounting the difficulty is to select a collar which fits perfectly, and make a depression in the lining immediately over the gall, sufficiently deep and wide to prevent the collar coming in contact with it. The depression is made by removing some of the stuffing and drawing in the lining with a few stitches. This is called "chambering" the collar.

Another method is to have small pads stitched to the collar above and below the seat of injury, to remove the pressure. Some horse-owners, in the absence of a saddler, use stockings stuffed with horse-hair as a substitute for the pads. By adopting means such as these, the horse can be worked while the injury is healing.

The Hames.

For heavy work these are usually made of steel, either single or double plated. The latter are more expensive, but are more durable and less likely to suddenly snap when the horse throws himself into the collar.

Hames for drays are made with short tug-chains attached, but on the farm it is more convenient to have them fitted with hooks, so that they can be used with separate short tugs for dray-work, or with chains for ploughing.

They should fit perfectly in the groove of the collar. A chain connects them at the bottom, and this can be lengthened or shortened to enable the hames to be adjusted to the size of the collar. This coupling must not be made too long, or in buckling the hames at the top they will be drawn in too closely and pinch the neck; if, on the other hand, the connecting chain is too short, they do not fit well round the collar.

The hook for attaching the tug or plough chains must be placed in such a position that the draught is not thrown on to the movable shoulder-joint. If the point of attachment is too low, the upper end of the collar is drawn slightly forward.

In some horses the body swells outwards considerably beyond the shoulders, and the chains chafe the sides. This can be prevented in most cases by putting a thick leather pad beneath the hame-hooks, to throw them outwards. If this fails the chains must be covered with leather or strong cloth.

The Backband.

In plough-harness this is very simple, and serves merely to carry the reins and to prevent the chains falling too low and getting under the feet in turning. It should be of such a length that when the chains are tightened it rests comfortably on the back and is not thrown up above it. When it is in the proper position the flaps should be about 9 inches behind the elbow-joint.

The Chains.

The chains vary in weight according to the class of work. They should be strong but fairly light, except where leading horses are used, when heavier chains are required. The length should be sufficient to allow the swingle-bars to clear the heels when turning the horses. If too long they interfere to some extent with the draught, and may get under the feet in turning; while if too short the swingle-bars catch against the heels. In hard, uneven ground, plough-chains should be fairly long. The swivels must be kept in good order to prevent twisting of the chains, with consequent risk of breakage.

The Reins or Lines.

These are usually of rope in plough harness. A clasp at one end is a convenience in attaching them to the bit. Heavy lines should not be used, as they cause a drag on the horse's mouth, especially when wet. Rope of 1¼ inches circumference is the most suitable for ordinary work.

They are passed through the terrets or rings on the backband, but not through those on the hames. If they are passed through the latter the

horse's head is pulled upwards rather than outwards, and he does not answer to the rein well. They should not be too long, and if they must be taken up in length, it can be done most conveniently at the bit by tying a bowline knot; the spare rope can be tied up to the hames out of the way. (Fig. 1.)

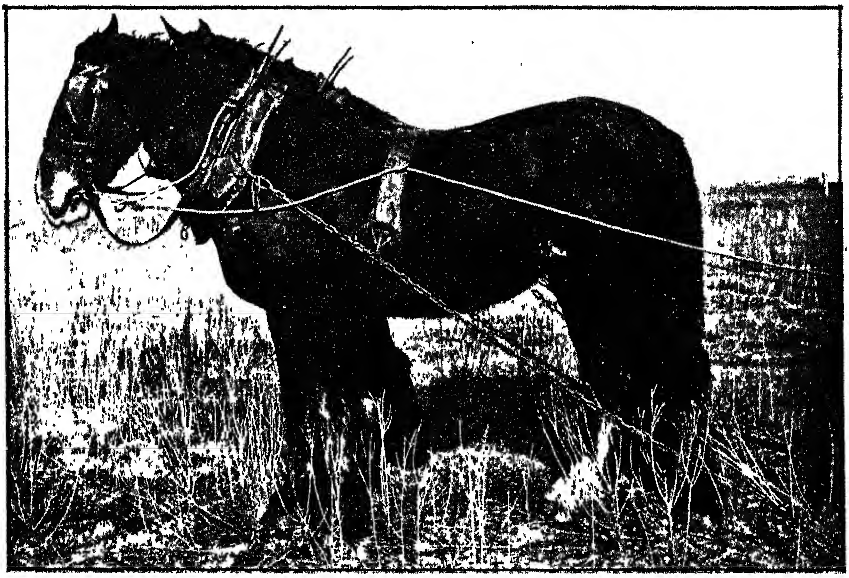


Fig. 1.—Plough Harness.

Showing the correct position of the hame hook, the position of the back-band, and the method of attaching the lines.

LEADING HARNESS.

This differs from plough harness principally in that a heavier backband and more complicated fittings are required to support the chains. The winkers, collar, and hames are essentially the same. A broad band of leather, divided into two straps at the fore end, passes through a loop in the backband, along the back to the tail, where it ends in a crupper. Two meeter straps are attached with a loop and keeper to the hames, or are stitched to the collar itself about 5 inches below the top of the collar, and the straps attached to the backband are buckled to these to keep it in position.

The chains pass through two rings on each side of the backband, and are held up behind by hip-straps. These straps should be of such a length that they prevent the chains and spreader dropping too low (Fig. 2). The chains must not be held too high by them, or the horse will pull down against his own back; neither should they be too low.

The right point for the attachment of the hip-straps to the chains is about 6 or 8 links in front of the spreader. A carrier-strap is frequently brought down over the hips and attached to the spreader. This should be buckled round the spreader about 6 inches in from the chain.

The spreader keeps the chains apart and prevents them from coming in contact with the horse's sides. It should be attached to the chains immediately behind the horse, but leaving sufficient space for the free movement of the legs. When the chains are tight the spreader should be just a shade behind a perpendicular line through the hocks.

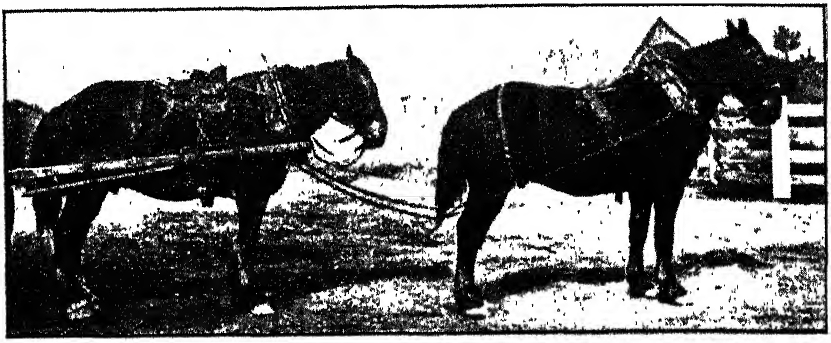


Fig. 2.—Leading Harness.
Showing the correct points of attachment of back-band, hip-straps, and spreader to the chains.

DRAY HARNESS.

The winkers, collar, and hames may be those used in plough harness, but they are often more elaborately mounted. This, however, does not add to their utility. The hames may have tug-chains attached, or may be fitted with hooks for the attachment of separate tugs. A saddle is used to carry the shafts, and attached to this is the breeching, designed to hold the saddle in position, and to enable the dray to be held back by the breeching-chains. The saddle consists essentially of pads to protect the back, and a groove to carry the back-chain. It must be well stuffed and properly adjusted to prevent injury to the back. Galls are almost as frequently caused by ill-fitting saddles as by collars.

The shafts are supported by the back-chain, which passes over the saddle and is attached to hooks on the runners or travelling bars on the shafts. The runners should have their centres directly perpendicular with the groove on the saddle when the tug-chains are tight. They are sometimes placed in the wrong position, and must be shifted.

The back-chain should not be too long nor too short. When the shafts are hooked up the points should be about 3 inches below where the tug-chains leave the hames. If hooked up too short the horse actually pulls against himself.

The tug-chains are hooked up so that the back-chain is kept in the centre of the runners under normal conditions, with freedom to move backwards or forwards in sympathy with the movements of the horse (see Fig. 3).

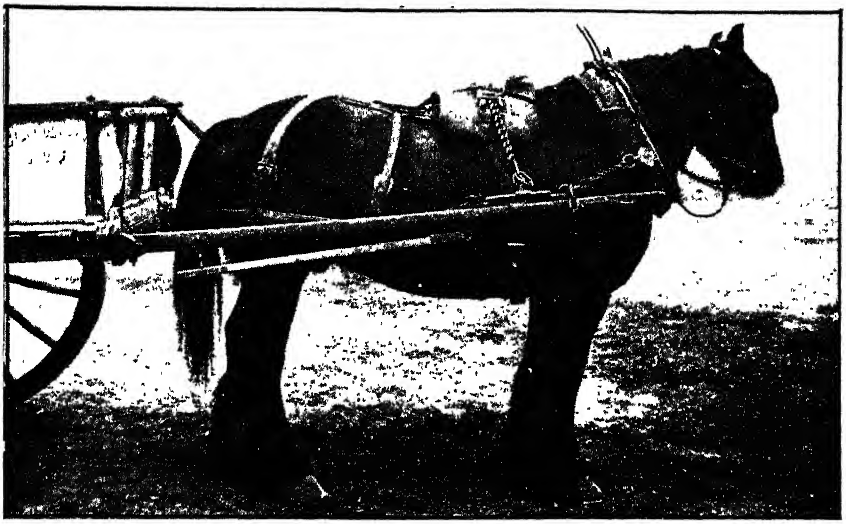


Fig. 3.—Dray Harness.

Showing the correct length of the back-chain, tug, and breeching-chains; and also the right position of the travelling-bar on the shaft.

The breeching-chains should be just slack enough to allow free action of the hind legs. It is not infrequently noticed that the tug-chains are too long, and, instead of the load being drawn by them, it is drawn by the back-chain. The breeching-chains, also, are often too long, and when the horse attempts to hold the load the breeching cannot perform its function, and the load is held back by the back-chain. This pushes the saddle forward against the wither, causing pinching, and probably setting up the conditions which lead to fistula.

(To be continued.)

Maraschino Cherries.

The I. Rheinstrom and Sons Company, Inc., of Cincinnati, U.S.A., a large firm of manufacturers of Maraschino cherries (used as a liqueur), have represented to the Colonial Office in London that they use about 2,000,000 lb. of cherries each year, and that supplies from Italy and California are not coming forward in sufficient quantities. They suggest the possibility of New South Wales and Victoria being able to supply the right type of cherry.

The varieties required are those known under the general term of Morella cherry, of which the best example is the Royal Ann (Bigarreau Napoleon).

They must be of a firm texture, as a weak fibre is injured in the process of manufacture, and of even shape and size. The size varies from 18 millimetres, measuring the large way, to 24 or 25 millimetres, and in practice the cherries are packed in two sizes—17 to 21 and 22 to 25 millimetres respectively. They are reddish or red, but the dark Bigaronn cherry cannot be used.

In addition to strong fibre, the stone or pit of the cherry should be loosely held for ease of extraction. The varieties in which the stones cling are unsuitable.

The cherries are picked at maturity, but not over-ripe, and packed without their stems. The barrels should hold about 300 lb. of cherries and 15 to 20 gallons of salt brine of standard specific gravity. The cherries are then sulphured in the barrels, a process which the firm would have to explain. Any form or shape of cask will do, provided it is sound and strong for standing the sea voyage.

The only reasonable freight route would be *viâ* Cape Horn, as freight from San Francisco or Seattle to Cincinnati is too expensive.

The quantity which the firm could take this season, in December or January, is 500,000 lb. Next year it would be 1,000,000 lb. The price suggested for cherries, carefully selected and packed, is 3½ cents (1¾d.) per lb. f.o.b. Australian port.

The company also ask for samples of canned cherries of last year's crop to test at once. They would also like 100 lb. of a yellow or reddish-yellow cherry, put up in cans similar to the canned cherries of San Francisco, if such are on the market here.

The general manager, Mr. W. L. Bodman, says that if there is any probability of a favourable conclusion one of the firm would visit Australia to arrange the financial question, instal a sulphur and packing plant, and make other arrangements.

The Royal Ann (Bigarreau Napoleon) cherry grows to perfection in almost all our cherry-growing districts, and the Department has invited Mr. Bodman to visit Australia during the cherry season, from 1st December to middle of January; or to send full particulars as to sulphuring, &c. Perhaps our canning firms would supply samples of best light-coloured cherries as desired, and also forward 100 lb. of best yellow and reddish-coloured cherries as canned. Probably no business could be done this year, or until our growers were educated in the proper curing and handling of the fruit. The price quoted also seems very low.

Address samples, &c., to W. L. Bodman, Esq., General Manager, I. Rheinstrom and Sons Co., Inc., Cincinnati, U.S.A.

Analyses of Various Lead Arsenates.

A. A. RAMSAY, Chemist's Branch.

As insecticides, arsenical preparations have been used for many years, the compound most generally used being the arsenite of copper—"Paris Green." Later, a lead compound of arsenic has found much favour, viz., lead arsenate. Arsenic (metallic) forms with oxygen two compounds:—(1) Arsenious oxide (AS_2O_3), which is familiarly called "arsenic" or "white arsenic," and which forms compounds termed "arsenites"; and (2) Arsenic oxide (AS_2O_5), which forms compounds termed "arsenates."

The substance (base) that the arsenious or arsenic oxide combines with gives the name of the arsenite or arsenate. Thus the combination of arsenious acid with soda, lime, copper, and lead would produce sodium, calcium, copper, and lead arsenites respectively; while the combination of arsenic oxide with soda, lime, copper, and lead would give rise to sodium, calcium, copper, and lead arsenates respectively.

The method generally used for the production of arsenate of lead is by double decomposition. A solution of certain lead salts (nitrate or acetate) in water is added to a solution of arsenate of soda (disodium arsenate) in water, with the result that the sodium and the lead change places, and we have arsenate of lead formed, which is practically insoluble in water, and appears as a white precipitate.

In Watt's Dictionary of Chemistry,* it is stated that triplumbic arsenate is formed by dropping a lead salt into excess of disodium arsenate, and that a tetra-plumbic salt is formed on mixing a solution of lead nitrate with arsenic acid or with less than an equivalent quantity of disodium arsenate.

In the new edition of this work by Morley and Muir†, nothing is stated except that the diplumbic salt is formed by double decomposition, and may be converted into the triplumbic arsenate.

Pickering‡ has shown that where 2 molecules of disodium arsenate react with 3 molecules of lead acetate, 1 molecule of triplumbic arsenate is produced. Theory requires 3·056 parts lead acetate for 1 part anhydrous arsenate present, and the mean value found by experiment was 2·999. He

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* Watt's Dictionary of Chemistry (pub. 1863), I, p. 382.

† Watt's Dictionary of Chemistry, edited by Morley and Muir, Vol. I, p. 308.

‡ Journal Chem. Soc., March 1907, page 307.

further states that the reaction is the same whether the acetate is added to the arsenate, or *vice versâ*. These experiments, conducted at the New Jersey Agricultural Experiment Station*, showed that the action of lead acetate on disodium arsenate produced a triplumbic arsenate, and that the reaction of lead nitrate on disodium arsenate produced triplumbic arsenate.

The literature of lead and arsenic compounds to which we have had access contains no reference to any higher lead arsenate than the triplumbic arsenate; so that in our analyses of lead arsenates, where lead is present in greater quantity than that necessary to form triplumbic arsenate, we have stated that lead to be in excess.

In examining the various arsenates of lead submitted in July last, several processes were tried for the separation of arsenious and arsenic acid when together. The methods given by Fusenius† of (1) precipitating the arsenic acid by magnesia mixture and the arsenious acid in the filtrate from the ammonium-magnesium arsenate by sulphuretted hydrogen; and (2) distilling the mixture of arsenious and arsenic acids with salt and sulphuric acid, determining the arsenious acid as being that contained in the distillate, and the arsenic in the residue—were tried and abandoned on account of inaccuracies.

The following scheme was, after these investigations, adopted:—The moisture was determined in the original paste, and a portion of the original paste dried, ground up, and bottled, and the analysis carried out on the dried portion.

Moisture in dried portion was determined, 5 grams powder being dissolved in nitric acid and made up to 250 c.c.

Lead was determined in 25 c.c. of above solution by adding sulphuric acid, heating till white fumes were given off, adding alcohol, allowing to stand, and filtering off lead sulphate, &c.

Total Arsenic: In filtrate from "Lead" by driving off alcohol, adding water and a little nitric acid, boiling, cooling, and neutralising with ammonia, and precipitating arsenic with magnesia mixture.

Arsenic as Arsenious Acid: 2·5 or 5 grams of sample was brought to boil with hydrochloric acid, cooled, filtered, neutralised with sodium carbonate, and filtered.

Arsenic was determined in filtrate by titration with iodine. A blank with the same quantity of hydrochloric acid alone was run and allowed for.

The several constituents were then calculated to the original moisture content of the sample.

* New Jersey Exp. Sta., Bull, 222.
† Fusenius, "Chemical Analysis," pages 485 and 489.

Samples of lead arsenate from all procurable sources were obtained by the Stores Supply Committee as retailed, and in the original tin or bottle unopened. The results of the analyses are as follow :—

TABLE I.—Composition of original substance, as received.

No.	Brand.	Moisture.	Total lead as lead oxide.	Arsenic as arsenic acid.	Arsenic as arsenious acid.	Total arsenic as arsenic acid.	Undetermined matter by difference.
1	Red Seal	76·59	15·55	5·33	0·01	5·35	Insoluble ... 0·13 Undetermined 2·38
2	Blyth's "Blue Bell"	39·37	42·55	11·58	0·26	11·88	6·20
3	Nicholl's*	39·12	40 26	11·28	0·02	11·30	9·32
4	Federal	48·68	33·74	7·78	0·04	7·82	Insoluble ... ·41 Undetermined 9 35
5	Swift's	48·80	33·36	13·56	......	13·56	4·28
6	Jenkins' "Austral"	28·76	45·97	11·63	0·17	11·82	13·45
7	Vreeland's "Electro"	32·41	41·65	20·03	......	20·03	5·91
8	Platypus	66·61	23·41	6·74	·00	6·75	3·23

TABLE II.—Analysis of Dry Powders.

No.	Brand.	Moisture.	Total lead as lead oxide.	Arsenic as arsenic acid.	Arsenic as arsenious acid.	Total arsenic as arsenious acid.	Undetermined matter by difference.
1	Red Seal	0·56	66·06	22·66	0·06	22·73	Insoluble ... 0·55 Undetermined 10·10
2	Blyth's Blue Bell ...	0·20	70·03	19·06	0·43	19·56	10·21
3	Nicholl's	0·31	65·92	18·47	0·03	18·50	15·27
4	Federal	1·08	65·04	15·00	0·07	15·08	Insoluble ... 0·79 Undetermined 18·01
5	Swift's	0·05	65·12	26·48	......	26·48	8·35
6	Jenkins' Austral ...	0·28	64·35	16·28	0·24	16·55	18·82
7	Vreeland's Electro..	1·01	61·00	29·34	... ..	29·34	8·65
8	Platypus	0·17	70·00	20·15	0·01	20·17	9·66

TABLE III.—Showing the weight of 100 c.c. of the dry arsenates and their apparent specific gravity.

No.	Brand.	Weight of 100 c.c.		Apparent Specific Gravity.	
		Loose.	Packed tightly.	Loose.	Packed tightly.
1	Red Seal	61·35	82·76	0·613	0·828
2	Blyth's Blue Bell	151·53	197·20	1·515	1·927
3	Nicholl's	211·98	260·36	2·120	2·604
4	Federal	219·34	280·34	2·193	2·803
5	Swift's	61·20	93·72	0·612	0·937
6	Jenkins' Austral	140·36	204·64	1·404	2·046
7	Vreeland's Electro	72·38	121·85	0·724	1·219
8	Platypus	146·48	207·36	1·465	2·074

* Since these samples were obtained, the name "Nicholl's" has been changed to "Our Jack."

TABLE IV.—Showing Rate of Settlement of these Arsenates when made up according to Printed Instructions on the package or bottle.

No.	Brand.	Time in Minutes													
		2	4	8	13	18	23	28	33	38	43	48	53	58	63
		c.c. of Settlement.													
1	Red Seal	5	10	15	28	40	55	75	80	100	150	225	275	350	375
2	Blue Bell	5	25	25	40	75	100	200	300	400	500	...	...	...	...
3	Nicholl's	5	30	45	70	100	200	400	500	...	...	...	...	...	...
4	Federal ...	...	10	20	25	55	60	70	90	100	175	225	275	350	375
5	Swift's ...	...	...	...	...	1	2	3	4	5	10	11	12	13	20
6	Austral ...	10	12	35	60	110	175	200	250	350	375	500	...	...	...
7	Electro ...	...	2	8	20	25	40	55	65	75	...	...	...	...	80
8	Platypus	20	25	70	185	250	310	375	500	...	...	...	...	...	...

On inspection of the analytical figures given in Table I, it will be noted that in the case of—

1. *Red Seal Brand.*—5·35 parts arsenic acid and 15·55 parts lead oxide are present, conforming to a triplumbic arsenate.
2. *Blyth's Blue Bell.*—11·88 arsenic acid and 42·55 lead oxide are present, being an excess of 8·06 parts lead oxide over that required theoretically to form triplumbic arsenate.
3. *Nicholl's.*—11·30 arsenic acid and 40·26 lead oxide, an excess of 7·48 parts lead oxide.
4. *Federal.*—7·82 arsenic acid and 33·74 lead oxide, an excess of 11·06 parts lead oxide.
5. *Swift's.*—13·56 arsenic acid and 33·36 lead oxide are present, which corresponds with a mixture of 18·65 parts diplumbic arsenate and 28·76 parts triplumbic arsenate.
6. *Austral.*—11·82 arsenic acid and 28·76 lead oxide, being an excess of 11·67 parts lead oxide above that theoretically required to form triplumbic arsenate.
7. *Electro.*—20·03 arsenic acid and 41·65 lead oxide, corresponding with a mixture of 11·67 parts triplumbic arsenate and 51·34 parts diplumbic arsenate.
8. *Platypus.*—6·75 arsenic acid and 23·45 lead oxide, being an excess of 3·82 parts lead oxide.

In the dry state, Electro contains the highest percentage of arsenic ; and in this order follow Swift's, Red Seal, Platypus, Blue Bell, Nicholl's, Austral, and Federal.

The moisture present in the samples examined varies considerably, from 28·76 in "Austral" to 76·59 in "Red Seal." In the latter case the makers of this brand have explained that their ½ lb., 1 lb., and 2 lb. bottles contain ½ lb., 1 lb., and 2 lb. respectively of lead arsenate, containing an average of 40 per cent. water, and then more water is added to fill the bottles.

The time taken by mixtures of these preparations with water to settle varies considerably, and is greatest in the case of Swift's, followed by Electro, Red Seal, Federal, Austral, Blue Bell, Nicholl's, Platypus—the last four named settling out very quickly.

On glancing at the apparent specific gravity of the dried arsenates, one is struck with the great variations shown, viz., from 0·6 to 2·2—one nearly four

times the other. Arranged from lowest to highest, these are Swift's, Red Seal, Electro, Austral, Platypus, Blue Bell, Nicholl's, Federal.

It will be noted also that though the first four and last four, as groups, are those that comprise the slowest settling and quickest settling arsenates, it is curious that one of these, showing a specific gravity of 2·2, follows very closely on the line of settlement followed by one of specific gravity 0·6.

TABLE V.—Showing pounds of Lead Oxide and Arsenic Acid in 1 lb. of the Arsenate as vended.

No.	Brand.	Lead Oxide PbO.	Arsenic Acid As_2O_5.	Expressing As_2O_5 present, taking highest arsenic content = 100.
2	Blue Bell	·4255	·1158	59·3
3	Nicholl's	·4026	·1130	56·4
4	Federal	·3374	·0782	39·0
5	Swift's	·3336	·1356	67·7
6	Austral	·4597	·1182	59·0
7	Electro	·4165	·2003	100·0
8	Platypus	·2341	·0675	33·7

From the above table it is seen that if the arsenic acid present be taken as a measure of the efficacy of the arsenate as a poison, Electro is the highest, containing about one-third more arsenic than Swift's, and from one and three-quarters to nearly three times as much as any of the others.

NOTE.—Red Seal brand has been excluded, for reasons stated above.

TABLE VI.—Comparison of Analyses made in other States with those made in New South Wales.

	Victoria.	South Australia.	Queensland.	New South Wales.
Swift's—				
Moisture	44·60	47·10	42·80	44·09 48·80
Lead oxide	37·28	35·66	39·70	37·06 33·36
Arsenic acid ...	15·23	15 17	17·04	12·65 13·56
Nicholl's—				
Moisture	22·20	25·95	....	25·90 39·12
Lead oxide	46·70	48·99	....	46·93 40·26
Arsenic acid ...	14·80	15·62	......	12·06 11·30
Blyth's Blue Bell—				
Moisture	41·00	39·10	50·90	47·19 39·37
Lead oxide	40·30	42·87	34·90	37·06 42·55
Arsenic acid ...	12·56	12·72	10·72	10·21 11·88
Platypus—				
Moisture	73·3 46·15	68·9	67·2	66·61
Lead oxide	18·87 38·28	22·87	24·5	23·41
Arsenic acid ...	6·05 12·20	7·01	7·8	6·75
Federal—				
Moisture	45·90	....	....	51·50 48·68
Lead oxide	33·80	....	....	33·31 33·74
Arsenic acid ...	14·70	....	....	9·68 7·82
Austral—				
Moisture	36·20 50·10	59·47	....	28·76
Lead oxide	43·18 31·63	27·87	....	45·97
Arsenic acid ...	13·90 11·02	8·87	....	11·82
Red Seal—				
Moisture	71·00	....	....	76 59
Lead oxide	19·20	....	....	15·55
Arsenic acid ...	7·80	....	....	5·35

TABLE VII.—Comparison of Analyses made in other States with those made in New South Wales. (Calculated to dry substance.)

	Victoria.	South Australia.	Queensland.	New South Wales.
Swift's—				
Lead oxide	67·3	67·4	69·4	66·3 65·2
Arsenic acid ...	27·5	28·7	29·8	22·6 26·5
Nicholl's—				
Lead oxide	60·0	66·2	....	63·3 66·1
Arsenic acid ...	19·0	21·1	....	16·3 18 6
Blyth's Blue Bell—				
Lead oxide	68·3	70·4	71·1	70·2 70·2
Arsenic acid ...	21·3	20·9	21·8	19·3 19·6
Platypus—				
Lead oxide	70·7 71·1	73·5	74·7	70·1
Arsenic acid ...	22·7 22·7	22·5	23·8	20·2
Federal—				
Lead oxide	62·5	....	....	68·7 65·7
Arsenic acid ...	27·2	....	....	20·0 15·2
Austral—				
Lead oxide	67·7 63·4	68·8	....	64·5
Arsenic acid ...	21·8 22·1	21·9	... .	16·6
Red Seal—				
Lead oxide	66·2	....	....	66·4
Arsenic acid ...	26·9	....	....	22·9

TABLE VIII.—Showing extent of variation of the several Arsenates in Lead Oxide and Arsenic Acid respectively.

Brand.	Lead Oxide (PbO).			Arsenic Acid (As_2O_5).		
	From—	To—	Extent of Variation.	From—	To—	Extent of Variation.
Swift's	65·2	69·4	4·2	22·6	29·8	7·2
Nicholl's	60·0	66·2	6·2	16·3	21·1	4·8
Blue Bell	68·3	71·1	2·8	19·3	21·8	2·5
Platypus	70·1	74·7	4·6	20·2	23·8	3·6
Federal	62·5	68·7	6·2	15·2	27·2	12·0
Austral	63·4	68·8	5·4	16·6	22·1	5·5
Red Seal	66·2	66·4	0·2	22·9	26·9	4·0
Mean of all (7)	....		4·23	....		5·66

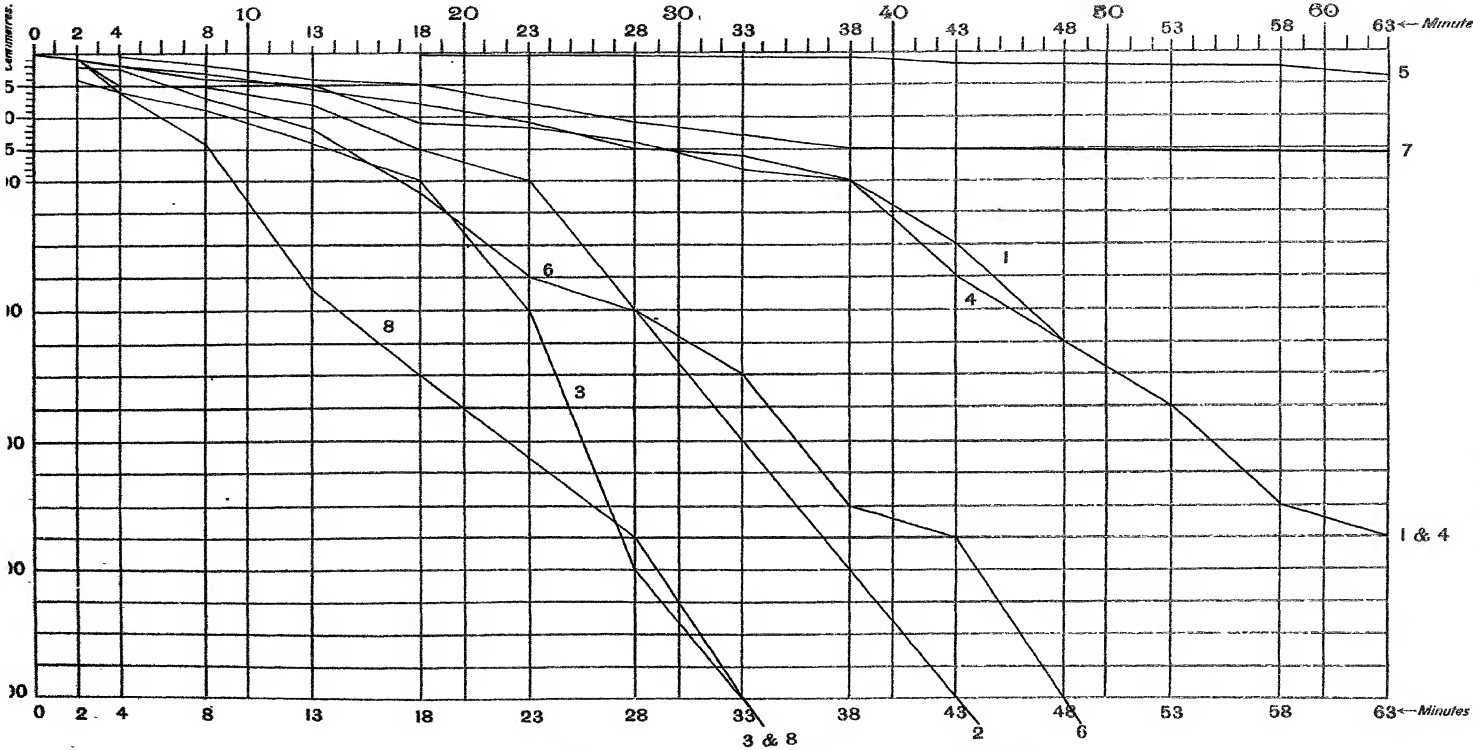


DIAGRAM SHOWING RATES OF SETTLEMENT OF VARIOUS LEAD ARSENATES.

1. RED SEAL. 2. BLYTH'S BLUE BELL. 3. NICHOLL'S. 4. FEDERAL. 5. SWIFT'S. 6. JENKIN'S AUSTRAL. 7. ELECTRO. 8. PLATYPUS.

The last table (VIII) bears out the findings of Haywood and McDonnell,* who obtain similar variations and conclude their investigations by stating:—

It was not to be expected, however, that a perfect product would be produced in all cases, especially as the material has not been manufactured until recently, and evidently some have taken up the business without proper knowledge of the subject. The product will no doubt be improved as its use and preparation become better understood.

With which statement I cordially agree.

Fumigating Nursery Stock.

"The Vine and Vegetation Diseases Act, 1901," does not empower the Department of Agriculture to compel nurserymen to fumigate nursery stock distributed within the State, but the Department deems it to be its duty to encourage such action in every legitimate way. The possibility of insect or fungus diseases being introduced into clean districts or healthy orchards with young nursery stock is too obvious, and has unfortunately been too much in evidence in past years to need comment at this time. It is not intended to reflect upon the quality or cleanliness of the stock sent out by our nurserymen, which is generally healthy and free from disease; but it is felt to be in the interests of nurserymen as well as of growers that all young trees should be fumigated before despatch.

The Department is prepared to publish in this *Gazette* the names of those nurserymen who will give an honourable undertaking that all nursery stock distributed within the State from their nurseries is fumigated before despatch, and it is hoped that by this means growers will be brought into touch with nurserymen whose produce can be relied upon as being free from disease.

The following nurserymen have given the desired undertaking up to the 21st October, 1910:—

Alex. Milling, Federal Nursery, Ermington.
S. D. Jack, Riverside Nursery, Ermington.
S. Warland, Namoi Nursery, Wahroonga.
Chas. W. Porter, Alma-street, Paddington.
T. McKee, Evergreen Nursery, Ermington.
J. B. McKee, Cumber Nursery, Ermington
(All deciduous trees and all citrus trees when required.)

* Lead arsenate; Bulletin 131, U.S. Department of Agriculture, 1910.

Cotton Growing.

MR. J. G. FLETCHER, of Walgett, recently forwarded to the Department of Agriculture a small parcel of "Virginian" cotton, grown by him. The Department obtained the following report on the sample, through the Agent-General, from Messrs. Wolstenholme and Holland, of Liverpool, England:—

15th June, 1910. We consider the value and description of your sample of Virginian cotton from the Department of Agriculture, New South Wales, to be this day as follows:—About "Good Middling," good colour, staple 1⅛ inch to 1$\frac{3}{16}$ inch, and strong. Value 8·45 to 8·50d. per lb. Present value "Middling American," 8·17d.

This is a very satisfactory report, showing that cotton of good quality can be produced in the north-west.

The world's demand for raw material for the cotton manufacturing industry is becoming very strong, and the British Cotton Growing Association was formed in 1902, for the express purpose of promoting the growing of cotton in the British Dominions. The Minister of Agriculture is in receipt of a communication from the Agent-General in regard to the work of the Association. Grants are made to the Governments of the various colonies in which cotton growing is being tried, and advances are also made to planters to enable them to purchase seed, machinery, &c., and they are assisted to market their cotton. Expert advice is also given to the local Governments on samples of cotton and other products, while estimates, plans, and general advice on machinery and ginning plant are given without charge.

Under its supervision experiments have been made with different varieties of cotton, in hybridising and fertilising, in the selection of seed and the raising of pedigree cottons; different classes of gins, engines, presses, &c., and different methods of handling and weighing cotton have been experimented with, and most important experiments are being carried out with cotton seed as fuel. The Association buys all the cotton which is grown under its supervision, but it may be stated that they frequently lose heavily over the experiments. Operations are carried on in the West Indies, Nyassaland, East Africa, Rhodesia, South Africa, Ceylon, and India.

The work of this Association is of the most patriotic and Imperial character, and it has been of great benefit to those colonies where cotton has been even partially established as an industry, both the commercial community, the producers, and the Government having largely benefited.

The Imperial Government has now recognised the excellent work being done by the Association, and has agreed to subsidise it to the extent of £10,000 a year, for three years, under special conditions. The value of cotton produced under its auspices during the years 1903 to 1909 inclusive, is estimated at £1,744,000.

Cotton has not been grown for commercial purposes in New South Wales, but it has long been known that it grows excellently and produces fibre of high quality. The Department is prepared to supply all available information to farmers proposing to attempt its cultivation on a commercial scale; and seed will be distributed for trial to any who wish to test the capabilities of their soil and climate.

Some Useful Insects.

WALTER W. FROGGATT, F.L.S., Government Entomologist.

The Red-bodied Robber Fly (*Craspedia coriaria*, Wild.).

ALL through the inland open forest country, in the summer time, this large, handsome fly can be found hunting for its prey. This consists of many different insects, and it is quite common to see one of these flies clasping a large brown cockchafer beetle (*Anoplognathus*) in its powerful hairy legs, while it drives its stout, horny, beaked mouth through the back of the cockchafer at the junction of the thorax and wing covers. If disturbed, it flies off, carrying the beetle quite easily in its deadly embrace.

The whole structure of this powerful fly, with its stout wings, long hairy legs, large eyes, and stout, horny, beak-shaped mouth, turned down under its head, is admirably adapted for its predatory, carnivorous habits. Nothing is known about its life history, but in England and America the larvæ of allied species live in the soil and feed upon roots and vegetable matter; they are of the usual typical maggot form of fly larvæ. When plentiful, these flies destroy a large number of injurious insects.

The Broad-bodied Robber Fly (*Blepharotes splendidissima*, Don)

The second species is more common on the coast, and on a summer morning may often be seen hunting over the flower-beds in the Botanic Gardens in Sydney. Instead of the body being red, it is black and shining, and more broad than long. It has similar habits to the red-bodied species, and its larvæ are also unknown.

The Devil's Coach-horse (*Creophilus erythrocephalus*).

This queer-looking carnivorous staphylinid beetle is a very useful insect, because it lives upon fly-maggots. It is often found in stables among the horse-manure in the stalls, running about looking for its prey. When disturbed it has a curious way of turning its head and sticking up the tip of its body. The black spots on the red head give it a quaint appearance, from which it has obtained its popular name of the "Devil's Coach-horse." One may often find it in the bush, under dead sheep or other decaying matter where dipterous maggots are to be found. It was an allied beetle that the West Australian entomologists brought from South America to kill out the fruit-fly maggot in their orchards, but which never became established.

The Yellow-horned Clerid (*Trogodendron fasciculatum*).

This handsome beetle has a wide range over Australia, flying about in the hottest part of the day. In summer it may be often noticed running along, moving its bright yellow antennæ from side to side. If it is handled carelessly it will bite savagely and hang on with its closed jaws. These beetles lay their eggs upon the pupæ or in the cavities made by many of the wood-boring moths. The larvæ destroy the pupæ of the moths, and when full-grown they pupate in the remains of their victims.

The Green Calosoma (*Calosoma Schayeri*).

This is one of our commonest ground beetles, and in both the larval and adult states it does extremely useful work in destroying the dull green caterpillars known as "cutworms." The hard-headed, slender larva, with great, powerful jaws, lives under the clods in the fields, capturing the cutworms in their hiding places. The handsome, metallic-green beetle usually hides in the same manner during the day, coming out and hunting during the night. Once or twice we have had them appear in thousands in the Sydney streets, when the small boy collected them in his handkerchief, and the strong acrid odour of the fluid which they discharge (probably as a protection against their enemies) was very noticeable wherever they congregated.

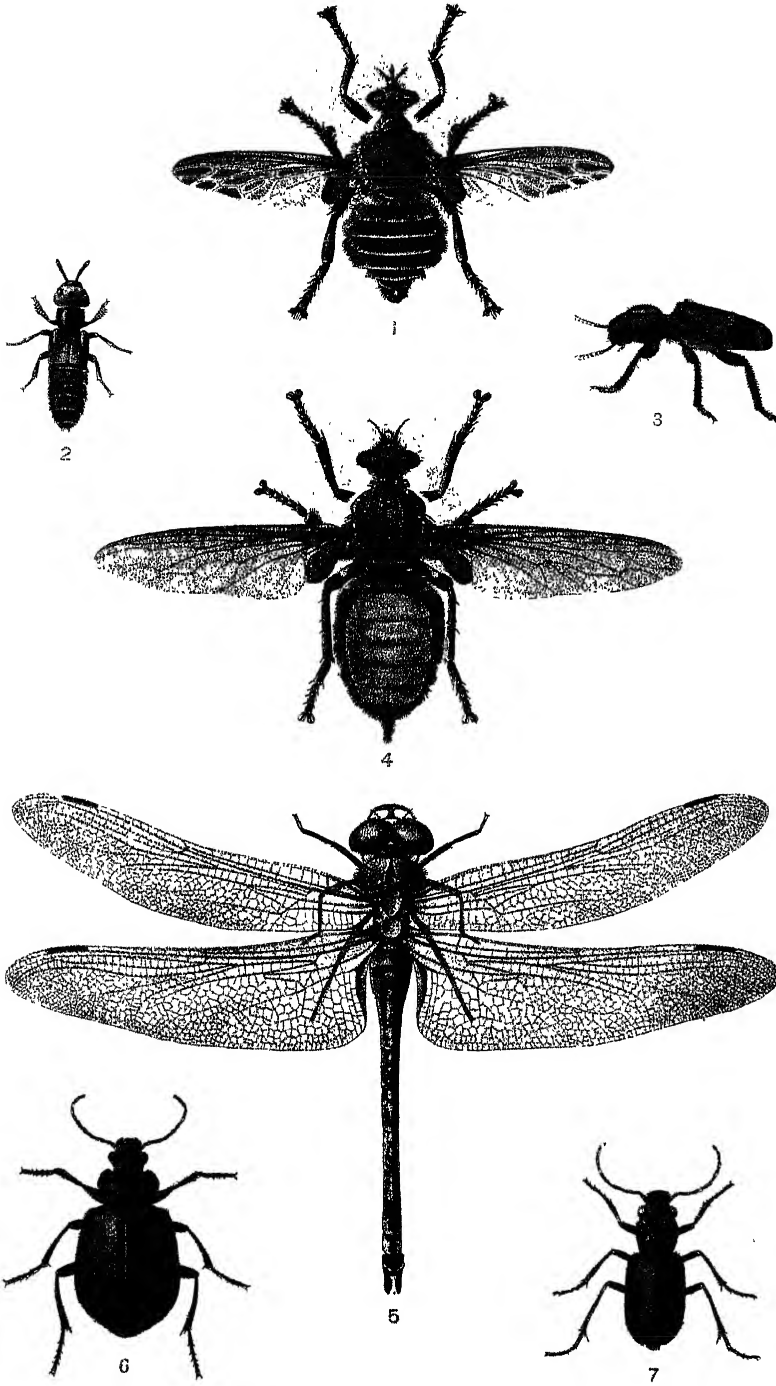
The Green Tiger-beetle (*Tetracha australasiæ*).

This fine tiger-beetle lives in burrows in the sandy soil along the edge of creeks, swamps, and watercourses, where both the large-jawed larvæ and the perfect beetles hunt their prey. These beetles hide during the day, coming out just at twilight, and run along the water's edge, where they can be often captured. They are also attracted to a light at night, and come flying into the house. They are furnished with very powerful jaws, and destroy a great number of noxious insects.

The Great Dragon Fly (*Æschna brevistyla*).

All the dragon flies are very useful insects. In spite of their popular name, "horse-stingers," they do not sting, and are perfectly harmless to man and stock. All dragon flies are carnivorous, and form one of the most useful groups of insects, owing to the fact that they kill enormous numbers of fly pests. When dragon flies are abundant they soon clear off the mosquitoes, which are their chief food, but they also eat many small flies and gnats.

This species has a wide range over the coast of Australia.



SOME USEFUL INSECTS.

1. BLEPHAROTES SPLENDIDISSIMA.
2. CREOPHILUS ERYTHROCEPHALUS.
3. TROGODENDRON FASCICULATUM.
4. CRASPEDIA CORIARIA.
5. ÆSCHNA BREVISTYLA.
6. CALASOMA SCHAYERI.
7. TETRACHA AUSTRALASIAE.

How the Soil acquires Nitrogenous Plant Food.

G. P. DARNELL-SMITH, B.Sc., F.C.S., F.I.C.,
Assistant Microbiologist, Government Bureau of Microbiology.

ALL the nitrogen taken up by a plant is absorbed from the soil, and must be present there in combination as a nitrate, or as an ammonium compound, before it is capable of being taken up by a plant as food. It may be supplied by decay of naturally occurring organic material; or it may be supplied by the farmer in the form of animal manure, or as artificial manure in the form of sodium nitrate, dried blood, or guano. But a further source of it which has attracted much attention in recent years is the atmosphere, where nitrogen exists abundantly as a gas. Formerly it was believed that this nitrogen was not available to vegetation, but it is now well established that certain organisms in the soil have the power of fixing atmospheric nitrogen and rendering it available as plant-food; and inasmuch as the supply of nitrogen in the atmosphere is practically inexhaustible, this source of it necessarily merits serious consideration.

Classification of Nitrifying Bacteria.

The micro-organisms already known to perform nitrifying functions in the soil are of three kinds, namely:—

I. Those which convert ordinary nitrogenous material into ammonium compounds, nitrites, and nitrates.

Bacteria have been described which convert ammonium compounds into nitrites, others which convert nitrites into nitrates, and others which convert ammonium compounds directly into nitrates. These bacteria are more especially concerned in rendering nitrogenous manures applied to the soil available as plant-food; and on the number of them in the soil will depend the value of certain manures.

II. Those which absorb atmospheric nitrogen and fix it in the soil in forms suitable for plant food. This function is performed by at least two groups of microbes, namely:—

(*a*) By bacteria which live in the nodules on the roots of leguminous plants (*Rhizobia*), and

(*b*) By bacteria which live free in the soil (*Azobacteria*).

Action of the Bacteria.

The bacteria of Class I are those concerned with the nitrogen derived from ordinary manures and fertilisers. These substances appear to be more or less readily rendered available to plants according to the amount of preparation which they have to undergo in order that the nitrogen may become converted into an absorbable condition.

The exact mode of action of the bacteria of the second class is not definitely known. In the case of those which live in the root nodules it is believed that in some way the plants feed the bacteria with carbonaceous matter (sugar), and that the bacteria feed the plant with nitrogen. These bacteria appear to have the power of taking atmospheric nitrogen and building it up in their tissues. It is possible that the plants afterwards obtain this nitrogen, not from the bacteria living in the nodules, but from those which die there, their bodies being digested by the plant juices, and the nitrogen absorbed by the plant.

In the case of those nitrogen-fixing bacteria which live in the soil, there may similarly be an elaboration of atmospheric nitrogen into the tissues of the microbes, with subsequent decomposition and conversion into nitrates; as in the case, and perhaps by the agency, of bacteria of the first class above mentioned. In the soil, therefore, the nitrogen to be available must be in the form of nitrates, and whether derived from manure or from the atmosphere, its conversion into this form is effected through the agency of bacteria. These considerations afford a guide to the practical application of nitrogenous fertilisers, and to the durability of their effects.

Nitrate of soda is at once available as a plant-food; ammonium sulphate must, as a rule, first be nitrified by the bacteria in the soil; whilst the nitrogen in farmyard manure, having first to undergo a series of changes brought about by bacterial action, and resulting in the conversion of the highly complex organic forms of nitrogen into the simple form of nitric acid, may take many years before it all finally becomes available as plant-food. Every soil, according to the bacterial flora it possesses, will deal differently with the manure, farmyard or artificial, with which it is supplied. In some soils and climates it may take many years before the nitrogen in farmyard manure is completely exhausted.

Rate of Decomposition of Farmyard Manure.

The extremely lasting character of those nitrogenous compounds in farmyard manure which are not recovered in the first year is illustrated in an exceptional manner in the Rothamsted experiments. On the grass land, for example, one plot received 14 tons of dung per acre per annum for eight years (1856-63), and then was left unmanured. It continued to give a larger crop than the unmanured plot alongside for more than forty years. In the first year after the application of farmyard manure had been stopped, the plot with the residues of the previous eight years' manuring gave double the yield of the unmanured plot; in the following year the yield was still double; but from that time its superiority has slowly declined, though for the past ten years it has still amounted to 15 per cent. ("Fertilisers and Manures." A. D. Hall, 1909, p. 212.)

In warmer climates the decomposition, on account of the greater bacterial activity, would probably be much more rapid. Hence, while the supply of nitrogenous material to a soil is important, a knowledge of the capacity of a

soil for dealing with a particular class of manure and rendering it available as plant-food is equally important. While this applies to nitrogenous manures especially, it applies in a less degree to phosphatic and potassic fertilisers.

Conditions Requisite for Nitrification.

Since the production of suitable nitrogenous food for the plants depends upon the life in the soil, the fertility in this respect will obviously vary as the conditions are suitable or otherwise for the existence of the beings concerned. This is a matter which, at the present time, is far from being well understood. Nevertheless, it is possible to indicate a few of the essential factors. In the first place, it seems necessary that the soil should be neither too acid nor too alkaline. This usually means that, in an ordinary fertile soil where organic matter is undergoing decay, and acid bodies like humic acid are being produced, the presence of lime is very important in order that it may neutralise the acid, and so protect the bacteria from its injurious action. Secondly, the products of bacterial activity are hurtful to the organisms producing them, and so must be neutralised or removed. The fallowing of land for any lengthy period is said to result in the suspension of bacterial activity in certain directions, including nitrogen fixation; this, it is said, being the effect of stagnation. Growing crops, tillage and drainage, improve matters in this respect. The amount of nitrogen fixation is closely governed by the amount of carbonaceous material supplied to the soil. Hence the ploughing in of green crops, while causing humus to be formed in the soil, adds to its fertility by providing carbonaceous material for the nitrogen-fixing bacteria to feed upon. On occasion it has been found that the crop following the ploughing in of a green leguminous crop has not been so great as a crop following the ploughing in of a green mustard crop—and the explanation is probably to be sought in the latter having acted as a better forcing ground for the nitrogen-fixing bacteria.

Since the conversion of nitrogen to nitrates demands oxygen, it is necessary that the soil should be sufficiently aerated. The effect of aeration in this respect is shown in the following table (quoted from "Outlines of Bacteriology," David Ellis, 1909, p. 177):—

TABLE giving the results of experiments carried out to show the effect of aeration and non-aeration at different depths in the soil.

Layer.	Aerated; Nitrogen present.	Non-aerated; Nitrogen present.
	per cent.	per cent.
i.— 1-20 cms. .	0·132	0·113
ii.—20-40 cms. ..	0·109	0·074
iii.—40-60 cms. ..	0·076	0·059
iv.—60-80 cms. ..	0·069	0·046

It need scarcely be said that the bacteria must have a supply of suitable food. This they derive in general from the organic matter present in the

soil. Nevertheless, it appears that there are associations between bacteria and other living beings in the soil, as, for instance, algæ. The probability is that these algæ supply carbonaceous matter to the bacteria, just as the legumes are said to do to their bacteria, and that the bacteria in return supply nitrogen to the algæ.

An Enemy of the Bacteria.

There are, doubtless, various conditions besides those already noticed which operate injuriously upon the nitrogen-fixing bacteria—for example, dryness, and excessive heat or cold. They seem to be also the prey of other forms of life. As was pointed out by Mr. Guthrie, in the *Agricultural Gazette* for May, 1910, p. 441, Messrs. Russell and Hutchinson, of the Rothamsted Laboratory, have shown that probably in all soils the development of nitrogen-fixing bacteria is kept in check by the presence in the soil of certain large unicellular organisms (*Protozoa*) which feed on the bacteria. This conclusion was reached as the result of experiments, which showed that partial sterilisation of soil and the killing of the protozoa thereby resulted in increased fertility.

It has since been pointed out by A. Howard and G. L. C. Howard that in the Indo-Gangetic Plain it has been the native practice for years to expose the soil to the sun during the hottest month of the year. They suggest that partial sterilisation of the soil and consequent increased fertility results thereby.

The mere drying of soil, however, will result in an increase in the amount of nitrates present, "In preparing soil for a determination of nitrates, it is necessary that the sample be dried quickly, by spreading it out in thin layers as soon as it comes from the field, and keeping it in an oven at a temperature of 60 degrees. During the air-drying a notable increase takes place in the amount of nitrates present." (*Technical Methods of Chemical Analysis*, by G. Lunze and C. A. Keane, 1908, Vol. 1, p. 861.)

Methods of Farming.

How best to obtain the essential nitrification of soil must be determined by experiment in the field; as has been pointed out by Hall, of Rothamsted, there may be several methods of farming that are wrong, but there are none that are absolutely right—the methods selected for adoption must depend on climate, soil, freight, markets, and all the fluctuating contingencies with which the farmer has to contend.

While virgin soil may accumulate nitrogen, inasmuch as the plants growing thereon are not removed, but die and decay on the spot on which they grew; an arable soil, from which crops are removed year after year, can only have its nitrogen supply increased by the addition of nitrogenous manures or by the ploughing in of stubble or green crops, leaving the nitrogen-fixing bacteria to do the rest. Burning a crop and adding the ashes to the land is not the same thing as ploughing in the crop. In the first case inorganic material only is added to the soil; in the second case the same inorganic material is added, together with carbonaceous material on which the nitrogen-fixing

bacteria can live, and which, during its decay, gives rise to humus. Feeding off green crops and ploughing in the stubble, or the application of farmyard manure, enrich the soil not only in virtue of the chemical constituents of the manure, but also because the soil acquires carbonaceous matter upon which the nitrogen-fixing bacteria can thrive. Thus, while artificial manures may supply the particular ingredients in which a soil is deficient, farmyard manure will add these, and more also—it will add to the power of the soil to fix the nitrogen of the atmosphere, and thus render it available as plant food. So far as nitrogen is concerned, its absorption from the atmosphere can be continued indefinitely; *i.e.*, given the right conditions, the nitrogen-fixing bacteria in the soil will continually carry on their work.

From the practical point of view the material (stubble, green crops, &c.) that is ploughed under, the depth of the furrow, and still more the angle at which the furrow slice is left and the degree of pulverisation, are of the greatest importance. It is also to be remembered that the amount of nitrification aimed at must be proportioned to the object of the crop. Nitrogen produces foliage: it is not wanted so much when the desire is to secure seed. In all crops where the production of a good yield of seed is the object aimed at, it has to be remembered that the production of a seed by a plant is an endeavour to reproduce itself, and that within limits the more adverse the conditions the greater will be the effort of the plant to reproduce itself before dying. A too ready food supply, or too great a quantity of nitrogenous manure, leads to the production of luxurious growth, and little or no effort on the part of the plant to reproduce itself, *i.e.*, to flower and so form seed.

Denitrification.

While the fixation of atmospheric nitrogen by bacteria has been demonstrated, and must take place upon an enormous scale, the composition of the air has remained practically constant, one-fifth oxygen and four-fifths nitrogen. This prepares us for the converse proposition—that certain bacteria set free nitrogen from nitrogenous compounds.

Quite a large number of bacteria found in the soil reduce nitrates, while others prevalent in farmyard manure will reduce its nitrogenous constituents to such a degree that free nitrogen is liberated. The best means of protection against this loss appears to be to keep the manure as compacted as possible. In this way aerobic fermentation is reduced. Aerobic fermentation, when complete, results in the conversion of organic matter into water, carbon dioxide, and ammonia, which are lost. The more compacted manure is kept, the greater will be the amount of anaerobic fermentation and the greater will be the percentage of fertility recovered.

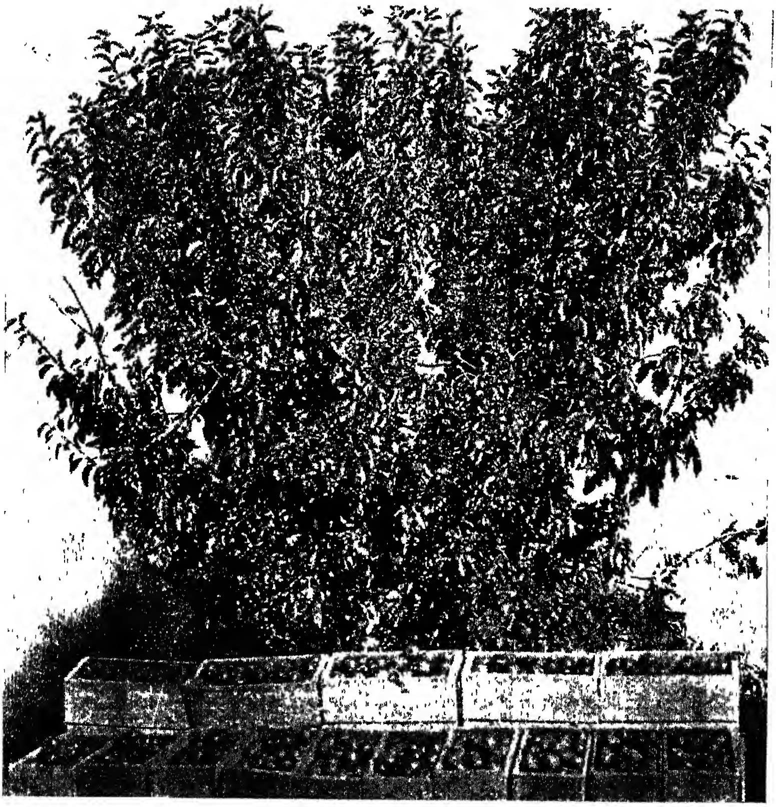
Granny Smith Apple Tree, 14 years old, Bathurst Experiment Farm, carrying 15 cases of fruit

Bluestone and Salt Treatment for Bunt in Wheat.

In the *Gazette* for May last, page 382, Messrs. Geo. L. Sutton and R. G. Downing gave results of experiments with fungicides used for the prevention of "stinking smut" (bunt), carried out at Cowra Experiment Farm in 1909, and, as a result of those experiments, tentatively recommended bluestone and salt as a farmers' treatment for the prevention of "smut." The experiments are being repeated at Cowra Farm this year, and the effect of the bluestone and salt upon the germination of the grain is found to be very variable. The variability appears to be influenced by the soil, by the variety, and by the condition of the variety; and the uncertainty of the action of the fungicide is apparent even on plots quite close to each other.

These conclusions are supported in a general way by reports from elsewhere. For instance, on the Farmers' Experiment Plots at Bogan Gate and Gilgandra, the germination of the seed treated with bluestone and salt is excellent, and all that can be desired; whilst at Narromine and Parkes it is very unsatisfactory. These results incidentally show one of the great advantages of farmers' plots in different parts of the State.

Because of this variability in action, Mr. Sutton does *not* now recommend bluestone and salt as a farmers' treatment. It will be advisable, until a better fungicide is found, to adhere to the bluestone and lime treatment, even though it is a little more troublesome.



Granny Smith Apple Tree, Bathurst Experiment Farm. After picking.

Sunlight a Possible Remedy for Irish Blight.

Mr. G. F. Kibblewhite, Experimentalist of Grafton Experiment Farm, in following up the work of Mr. D. McAlpine, Vegetable Pathologist to the Victorian Government, suggests that experiments might be devised to test the effect of exposing the tubers to strong sunlight at a maximum natural temperature.

There is a distinction between mere heating and exposure to sunlight—the latter having special effects. The point has been noted by the Bureau of Microbiology for observation, and inquiries in connection therewith have ascertained that blight has occurred in potatoes so exposed, it being the practice of some farmers to expose and "green" their seed potatoes prior to planting. It is possible that conditions may be found that will do better.

Cultivation of the Australian Opossum.

A. S. LE SOUEF, Director, Zoological Gardens, Sydney.

THE recent rise in the price of furs has brought into prominence various Australian animals which have skins suitable for ornamental muffs, stoles, and rugs. The best of those are the Tasmanian wallaby, the rock wallaby of New South Wales, the black and white variety of the native cat, and the two larger species of the opossum. The opossums are by far the most important, for not only do they carry the most valuable fur, but they feed on the leaves of the eucalyptus, and so are not detrimental to man's interests, as meat or grass-feeding animals are.

The Long-eared Opossum.

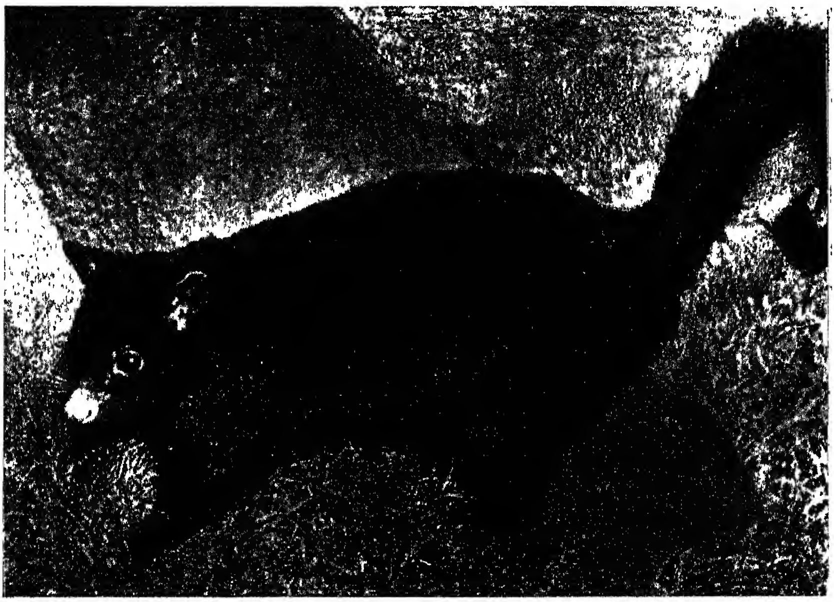
Varieties.

The two kinds are easily distinguished by their ears, the silver grey or common opossum having long ears, while the mountain or black opossum has short ears. The former is distributed all over Australia and Tasmania,

being generally found in the plain country; while the short-eared opossum is found on the highlands of Eastern Australia, and on the Islands of Bass Straits. It is the larger of the two, and has the most valuable skin.

Breeding and Food.

Opossums mate about April, and one young one is brought forth about June. They mature in twelve months, and will breed the first year. Their principal food is the eucalyptus, but they will also eat the leaves of many other trees, shrubs, and plants. They lie up during the day in holes in the trees, and also in logs, and come out to feed at night.



The Short-eared Opossum.

Colours, &c.

Great variations occur in the colour and texture of the fur, ranging from black to light grey, and from dark brown to rusty red, and they are sometimes white; as a general rule, the females have less red on them than the males, and they are a little smaller. The Tasmanian opossum is nearly always a handsome rich brown; the short-eared opossum is dark grey or black; while the long-eared or common opossum from the inland districts is light grey and more or less rusty red.

The fur of specimens from the cold mountain regions and Tasmania is dense and silky; those from Western Australia are smaller, and frequently brown, and have fine silky fur; while others from the islands off the south coast of Australia, from the mainland in the State of South Australia, and from the Northern Territory, show further differences.

Commercial Breeding.

Seeing the high prices that the skins of these animals are fetching, it behoves our farmers to give them very careful attention, and to breed them on commercial lines. The usual method of killing all that can be caught should be discontinued. A breeding stock should be established, and only the surplus sent to the sales. Thus every tree will become productive by providing food for an animal which will find a ready sale at a remunerative price, and the income of the farm or station will be increased by several shillings for every good-sized gum on the place.

Method of Catching.

The opossum is a quiet, inoffensive little animal, and very easily caught, since he will readily enter an ordinary drop-door trap if baited with a lump of pollard or a piece of bread. A simple method of keeping stock would be to place a number of small boxes, large enough to hold one individual, in the trees in an accessible position. The opossums would be glad enough to use these to sleep in during the day, and could be caught and examined at any time required.

A proportion of one male to three or four females would be the most economical number to have, and a little observation would show how many could be kept on any given area.

Fencing.

On an ordinary farm or station there would be no need to fence the animals in, but if such were necessary a 3-feet tin fence would be a sufficient barrier; or a strip of galvanized iron, 2 feet wide, secured on an ordinary rabbit-proof fence, and placed one foot from the ground, would suffice. The opossum cannot spring upwards.

Exclusive Farming.

Exclusive farming would pay best on the highlands in the south-east of New South Wales; in the Gippsland District of Victoria; or in Tasmania; for the heavily-timbered country would enable the maximum number to be carried per acre, and the skins produced would command the highest market price. It certainly would be an advantage to grow such cheap crops as kale or maize for the animals, and to plant saltbush and paspalum wherever they would grow. This would considerably increase the carrying capacity of the land, and the animals would reach maturity more quickly.

Although opossums drink water, they are often found far distant from it, and seemingly live for months without a permanent supply; probably the green leaves give all the moisture required.

Preparation of skins.

To fetch the top price the skins must be carefully taken off and tacked out to dry, with the sides straight and even. If they are to be stored for some time, a dressing of arsenical soap will keep away insect pests. The tail should be left on, but not the mask nor the skin of the legs below the first joint.

Experiments with Phylloxera-resistant Stocks at Howlong State Viticultural Station.

M. BLUNNO.

In the issues of this *Gazette* for June, 1906, and July, 1908, will be found the data referring to these experiments from 1904 to 1907, inclusive. The following tables now published bring the records up to last vintage.

The purpose of these experiments, as explained in previous issues, is to note the grape-bearing capacity of European vines after they have been grafted on phylloxera-resistant stocks. To do this it was necessary to have, side by side with the grafted vines, the same kinds not grafted, in order to compare the effect of the grafting upon the yield. The basis of comparison, as explained, would be the same vine growing on its own roots, which would be the "check," in the experimentalist's language. Not only the weight of grapes is recorded in the following sets of figures, but also the percentages of grape-sugar and grape-acids contained in them, with a view to ascertaining the influence that the graft might have on the two principal ingredients of the grape-juice.

The grape-sugar being composed of two sugars in almost equal proportions, viz., Dextrose and Fructose, also called Levulose, data have been recorded as to these.

It will be observed that the crops of the "check" vines and the analytical data thereof are only to be found for the 1908 season, because, while grape-picking was in progress in March of that year, phylloxera was detected on nine of those vines. This discovery of the parasite made it imperative to eradicate all those vines which were not grafted; therefore, after 1908, there are no "check" crops reported. However, the data available from 1904 to 1908 may be sufficient to show that, generally speaking, if the grafted vines do not yield more than the non-grafted ones, they do not yield less. In some cases, and in some years, indeed, the vines growing on their own roots yielded more than those grafted, but in other years the reverse is the case; and the contradiction may be explained by the fact that the pruning, instead of being as nearly as possible of the same style, and leaving on the two plots put in opposition the same number of fruiting canes and spurs, may have varied too much, thus accidentally giving one set of vines an advantage over the other. Results of experiments of this kind must be taken *in globo.*

Each vigneron will consider the crops of the variety or varieties of grapes which most interest him, and, seeing their behaviour for a consecutive number of years, strike a mean.

In studying these and the previous tables published in the *Gazette* numbers above mentioned, I would advise the grower to proceed in the following way:—

First, he ought to know what kind of phylloxera-resistant stock will suit his soil and subsoil. Suppose he is of opinion, or has been advised, that he should reconstruct his vineyard on the Riparia x Rupestris No. 3,309, or on the Rupestris du Lot. Suppose also that he intends to graft on them the Syrah, commonly called Hermitage. He should then take all the tables published, and begin by making a total of the crops yielded from 1904 to date, also making the same total for the percentages of sugar and of grape-acids contained in the Hermitage grafted on the two stocks respectively which he has been advised to plant. Then divide each total by the number of years of experiment, and so get the average, and see for himself which stock has given the best results when grafted with Hermitage.

The experiments, as may be seen, have been conducted with the principal kinds of phylloxera-resistant stocks generally employed in reconstruction, and on each of them the principal wine-grapes are grafted. The tables also permit of comparison between the different wine-grapes grafted on the same stock, and will guide the grower who is in doubt as to which to prefer among the red or among the white in order to get the largest crop, or the crop with the best relative proportions of sugar and grape-acids.

The vines forming the experimental plots are planted 10 feet x 8 feet, which gives 535 vines per acre. Each plot includes fourteen vines, and the crop off each is gathered and weighed, the yield being calculated in lb. per acre.

The system of pruning adopted is the double Guyot, consisting of two fruiting canes bent in opposite directions on the bottom wire, and two spurs. Last year some of the vines which in the past had grown much too vigorously in wood and foliage, to the detriment of the fruit, were so pruned as to abate the excessive vigour and dispose them to give more fruit and less wood and foliage. Thus a third, and even a fourth, rod were left in some cases, and these extra rods were carried on the second wire. The result was in every case such as was anticipated.

The soil at the Viticultural Station is clayey, very stiff in parts, and of medium fertility. The block of Riparia Gloire de Montpellier is on a sandy loam.

Howlong State Viticultural Station.

Weights per Acre and Analysis of Wine Grapes for Seasons 1908, 1909,* and 1910.

(1) Grafted on Riparia Gloire de Montpellier.

Variety.	Season.	Weight of Crop per acre.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit). °	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
		lb.							
1. Aleatico	1908	3,490	....	....	.	..	...	....	.
	1909	....	23·	24·	73	8·8	21·12	10·	11·12
	1910	6,120	24·	25·	73	7·4	24 20	....	..
Check	1908	5,370	28·5	28·	75	5·7	25·90	12·12	13·78
2. Cabernet	1908	2,819	...	....	.	.	....	....	..
	1909	....	23·	23·25	73	7·9	21·51	10·63	10·88
	1910	4,149	27·	28·	73	8·1	26·84	...	.
Check	1908	2,953	30·	20·	75	7·9	29·43	14·16	15·27
3. Lambrusquat	1908	3,222	....	....	..	..	....	....	..
	1909	. ..	20·	21·	73	11·8	16·91	.. .	..
	1910	3,759	22·	23·	75	5 6	22 41	. .	..
Check	1908	4,027	29·	28·	75	3·9	24·89	12·23	12·66
4. Malbeck	1908	.	.	. ..	..	..	....	....	..
	1909	....	24·	25	73	4·8	22·02	11·02	11·00
	1910	3,938	23·	23·5	75	5·7	23·66	....	..
Check	1908	2,685	. ..	....	..	..	....	...	..
5. Mammolo	1908	4,833	28·	27·	66	4·6	25·07	11·88	13·19
	1909	....	25·	26·	73	5·6	25·54	12 38	13·16
	1910	4,892	27·	28·	75	5·1	28·26	....	..
Check	1908	4,654	26·	25·	66	3·9	23·53	11·06	12·47
7. Muscat de Frontignac	1908	3,759	....	....	..		....	....	..
	1909	....	25·	27·	73	6·0	24·58	12·03	12·55
	1910	....	31·	32·5	75	7·0	31·94	....	..
Check	1908	... .	....	....	..	..	....	....	..
8. Verdot	1908	4,296	21 5	21·	63	7·9	19·14	9·22	9·92
	1909	...	20·5	21·	73	6·6	19·80	9·54	10·26
	1910	7,585	22·	23·	75	6·2	23·02	....	..
Check	1908	3,375	22·	21·5	63	5·7	19·54	9 3	10·24
9. Syrah	1908	4,027	. .	....	..	..	....	....	..
	1909	...	29·	31·	71	6·7	26·36	13·16	13·20
	1910	6.802	26·	27·	75	8·2	26·84	....	..
Check	1908	3.490	....	....	..	..	..	.. .	..
11. Verdelho	1908	10,203	29·	28·	66	8·6	26·92	12·72	14·20
	1909	....	26·	27·	71	7·0	25·72	12·75	12 97
	1910	9,666	29·	30·	75	7·0	30·13	....	..
Check	1908	2,013	28·	27·	59	7·2	23·51	11·34	12·18
12. Pedro Ximenes	1908	3,222	....	...	..	..	....	....	..
	1909	...	25·	26·	71	6 3	24·20	11·33	12·87
	1910	3,759	21·	22·	75	5·5	21·65	....	..
Check	1908	3,490	...	....	..	..	.. .	....	..
13 Pinot Blanc	1908	3,222	....	....	..	..	....	...	..
	1909	....	29·	30·	71	5·1	28·02	14·37	13·65
	1910	3,341	29·	30 5	75	6·6	28·52	....	..
Check	1908	1,611	....	....	..	..	....	....	..
14. Shepherd's Riesling	1908	4,027	.. .	. ..	..	..	....	....	..
	1909	....	26·	26·5	71	5·4	24·36	12·47	11·89
	1910	8,592	24·	25·	75	4·5	24·76	.....	..
Check	1908	2,148	. ..	....	..	..	....	....	..
15. Riesling	1908	4,296	.. .	...	..	..	....	....	..
	1909	....	19·	19-25	71	7·7	17·40	8·34	9·06
	1910	2,416	24·	25·	75	6·2	24·40	....	..
Check	1908	2,685	.. .	...	.	..	....	....	..
16. White Shiraz	1908	4,296	28·5	27·5	65	6··	25·68	12·34	13·34
	1909	....	20·	20·	71	7·9	19·16	9·09	10·07
	1910	8,681	20·5	21·	75	6·3	21 12	....	..
Check	1908	5,839	...	....	65	6 9	21·84	10·36	11·48
19. Tokay	1908	1,611	....	....	..	..	...	....	..
	1909	....	....	....	..	..	....	....	..
	1910	2,416	24·5	25·	75	3·6	23·84	....	..

* Weights were not taken for the 1909 Season.

(2) Grafted on Riparia x Rupestris 3,306.

Variety.	Season.	Weight of Crop per acre.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit).	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
		lb.			°				
1. Aleatico	1908	5,047	29·	28·	75	6·3	26·00	12·48	13·52
	1909	..	28·	29·	73	7·4	27·40	13·42	13·98
	1910	5,745	21·	21·5	75	8·3	20·94	.	..
Check	1908	....	28·5	27·5	75	5·2	26·18	12·52	13·66
2. Cabernet	1908	3,580	33·	32·	73	6·9	29·73	14·46	15·27
	1909	....	24·	25·	73	7·0	22·94	11·11	11·83
	1910	5,692	24·	25·	75	6·6	25·15	..	..
Check	1908	2,416	32·5	31·	73	6·9	27·47	13·34	14·13
3. Lambrusquat	1908	3,222	32·	31·	73	5·7	27·62	14·10	13·52
	1909	....	23·5	24·	73	8·3	23·07	10·95	12·12
	1910	6,175	21·	21·	75	6·4	20·80	..	..
Check	1908	5,191	32·5	31·	73	4·6	26·90	13·18	13·72
4. Malbeck	1908	5,638	27·5	26·5	77	3·9	24·66	11·62	13·04
	1909	....	26·	27·	73	4·8	25·02	12·18	12·84
	1910	7,115	24·	25·	75	4·1	24·40	..	..
Check	1908	2,685	27·5	26·5	65	3·3	26·77	13·10	13·67
5. Mammolo	1908	4,725	24·5	23·5	77	4·1	20·78	9·82	10·96
	1909	...	25·5	26·5	72	5·6	25·36	12·00	13·36
	1910	10,816	22·5	23·5	75	4·6	21·88	..	.
Check	1908	6,712	26·	25·	77	3·9	24·45	11·88	12·57
7. Muscat de Frontignac..	1908	4,698	33·5	32	77	6·	27·57	13·48	14·09
	1909	....	28·	29·	72	6·8	26·80	12·64	14·16
	1910	6,981	27·	28·	75	6·4	28·52	..	..
Check	1908	2,470	31·	30·	77	7·3	28·24	13·46	14·78
8. Verdot..	1908	6,872	27·5	26·5	66	5·3	24·94	12·52	12·42
	1909	....	22·	22·75	72	5·2	21·02	10·14	10·88
	1910	8,055	18·5	19·	75	5·8	19·07	.	..
Check	1908	4,027	22·5	22·	66	8·	20·38	10·00	10·38
9. Syrah	1908	5,370	35·	32·5	65	6·8	29·05	15·12	13·93
	1909	..	27·	29	73	8·6	27·24	13·51	13·73
	1910	7,876	27·	28·5	75	8·1	28·26	.	..
Check	1908	3,759	34·	32·	66	6·3	28·40	14·74	13·66
11. Verdelho	1908	5,262	30·5	29·	65	6·5	26·46	13·30	13·16
	1909	....	26·	27·	73	7·2	24·85	12·13	12·72
	1910	7,518	26·	27·	75	6·9	27·07	....	..
Check	1908	3,758	31·	30·	65	6·2	27·39	13·66	13·73
12. Pedro Ximenes.. ..	1908	....	30·5	29·5	66	5·1	29·88	14·34	15·54
	1909	....	21·	22·	73	6·	19·93	9·45	10·48
	1910	8,711	21·	21·	75	8·2	20·80	....	..
Check	1908	6,041	28·	27·	66	5·4	26·6	12·8	13·8
13. Pinot Blanc	1908	4.564	30	29·	66	6·1	24·94	11·68	11·78
	1909	...	27	28·	73	5·5	26·80	12·53	14·27
	1910	10,256	24·5	25·5	75	6·1	25·15	....	..
Check	1908	2,148	29·5	28·5	66	6·2	23·46	11·68	11·78
14. Shepherd's Riesling ..	1908	6,981	29·	28·	66	5·	25·14	13·20	13·21
	1909	....	28·	29·	73	5·3	26·65	13·25	13·40
	1910	9,666	23·	24·	75	6·3	23·84	....	..
Check	1908	3,490	30·	29·	66	4·8	26·47	12·28	12·66
15. Riesling	1908	....	25·5	24·5	68	5·7	23·69	11·36	12·33
	1909	....	....	....	..	..	....	.. .	..
	1910	4,833	22	23·	75	6·4	22·50	....	
Check	1908	3,759	25·5	24·5	68	5·5	23·69	11·48	12·21
16. White Shiraz	1908	9,988	23·5	23·	66	5·	23·12	11·04	12·08
	1909	....	21·	21·5	73	9·6	20·78	9·82	10·96
	1910	10,695	20·	20·	75	7·9	19·50	....	..
Check	1908	10,954	25·	24·	66	4·5	23·84	11·42	12·42
19. Tokay	1908	....	....	....	.	..	....	....	.
	1909	....	....	....				....	..
	1910	....	23·	24·	75	4·8	22·03	....	..

(3) Grafted on Riparia x Rupestris, 3,309.

Variety.	Season.	Weight of Crop per acre.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit).	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
		lb.			°				
	1908	1,879	27·	26·	73	10·	25·75	12·24	13 50
1. Aleatico .. .	1909	..	27·	28 75	73	8·8	26 08	12·78	13 30
	1910	4,027	22·	23	75	8·2	23·90	...	.
Check	1908	2,255	29·5	28·5	73	5·7	27·87	13·28	14·59
	1908	3,580	28·	27·	75	9·4	26 47	12 94	13 53
2. Cabernet . ..	1909	..	28·	29	73	7·4	26·36	12·80	13·56
	1910	2,148	25·	26·	75	7·5	26·18	....	.
Check	1908	2,416	32·5	31·	73	7·7	29·62	14·32	15 30
	1908	3,222	26·	25·	75	7·4	23 81	11·52	12·28
3. Lambrusquat	1909	....	25·	26·	73	8·9	22 29	10·50	11·79
	1910	2,846	24 5	25·5	75	6·2	25·76	....	..
Check	1908	3,043	29·	28·	75	4·2	.5·75	12·50	13 25
	1908	...	....	....	..	..	..	...	..
4. Malbeck	1909	..	24·	25·	73	4·6	22·42	10·88	11 54
	1910	3,356	23·	23·5	75	5·5	22·65	...	..
Check	1908	3,222	...	....	..	..	....	...	..
	1908	2,550	25·	24.	73	6·6	22·46	10 64	11·82
5. Mammolo . ..	1909	....	26·	27·	73	6·4	23 88	11·28	12·60
	1910	3,222	23·	23·5	75	6·3	23·48	....	.
Check	1908	4,296	27·5	26·5	73	4·2	25·90	12·24	13·76
	1908	3,222	....	....	..	..	....	....	..
7. Muscat de Frontignac	1909	....	30·5	32·5	73	6·3	28·20	13·72	14·48
	1910	1,812	22·5	23·	75	7·3	23·14	....	..
Check	1908	2,416	....	....	..	..	....	....	..
	1908	2,282	22·	21·	73	11·4	18·86	9·50	9·36
8 Verdot	1909	....	26·	27·	69	5·8	25·20	12·44	12·76
	1910	4,510	22·	23·	66	8·7	22·03	...	..
Check	1908	3,938	26·	25·	73	6·7	23 62	11·58	12·0
	1908	3,759	31·5	30·	73	10·3	28·92	14·56	14·3
9. Syrah	1909	...	31·	32 5	69	7·3	28 68	14·71	13·9
	1910	4,519	27·	28·5	66	9·6	27·77	...	..
Check	1908	2,685	34·	32·	73	6·7	30·10	15 40	14 7
	1908	8,592	33·	32·	72	7·4	28·08	14·02	14·0
11. Verdelho	1909	....	24·	24·5	69	7·9	21·26	10·10	11·1
	1910	4,833	26·	27·5	66	7·8	26·62	..	..
Check	1908	2,864	32·5	31·	72	7·	28·88	14·66	14·22
	1908	2,416	26·5	25·5	72	8·3	24·18	12·00	12·18
12. Pedro Ximenes ..	1909	..,..	26·	27·5	69	6·3	25·28	12·32	12·96
	1910	4,833	21·	21·25	66	7·6	20·48	. ..	..
Check	1908	4,117	25 5	24·3	72	6·6	24·05	11 54	12·46
	1908	....	29·5	28·5	73	4·	25·07	11·92	13·14
13. Pinot Blanc	1909	....	26·5	28·	69	7·1	28·05	....	..
	1910	3,490	26·5	28·	66	7·5	27·30	...	..
Check	1908	2,418	30·5	29·5	73	6·2	22·56	10·96	11·60
	1908	4,296	30·	29·	73	6·4	24·18	11·78	12·4
15. Shepherd's Riesling ..	1909	....	27·	28·5	70	5·4	26·94	13·20	13·7
	1910	4,940	27·5	29·	66	5·1	28·52	...	..
Check	1908	2,685	27·	26·	73	4·8	23·08	11·14	11·9
	1908	5,370	27·	26·	72	8·3	24·35	11·62	12·7
16. Riesling	1909	....	23·5	24 5	70	7·2	22·30	10·60	11·7
	1910	3,651	24·	25·	66	7·1	24·76	....	..
Check	1908	3,490	26·	25·	72	6·	23·80	11 56	12·24
	1908	4,296	27·	26·	72	6·	24·49	12·10	12·39
16. White Shiraz	1909	....	25·	25·	70	5·8	23·73	11·24	12·49
	1910	8,515	22·	23·	66	6·	23·00	....	..
Check	1908	7,249	18·	18·	72	5·7	16·70	8·22	8·48
	1908	....	....	....	..	..	....	....	..
19. Tokay	1909	....	....	....	..	..	....	. .	..
	1910	....	23·	24·	68	5·9	23 84	....	..

(4) Grafted on Riparia x Rupestris 101—14.

Variety.	Season.	Weight of Crop per acre.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit).	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
		lb.			°				
1. Alcatico	1908	3,490	33·	31·	65	6·	28·37	13·60	14·77
	1909	....	28·	29·	71	8·1	27·45	13·30	14·15
	1910	4,349	22·	23·	68	6·7	23·32	....	..
Check	1908	3,222	29·5	28·5	65	·7	25·61	11·88	12·72
Cabernet	1908	6,712	33·	31·	65	6·8	29·22	14·02	15·20
	1909	....	27·	28·	71	7·6	26·46	13·00	13·46
	1910	4,671	29·5	30·5	73	8·5	30·42	....	..
Check	1908	2,550	31·	30·	65	8·6	27·92	13·44	14·48
2. Lambrusquat	1908	....	....	....	.	..	....	....	..
	1909	....	25·	25·5	68	8·5	22·60	10·70	11·90
	1910	4,833	24·	25	73	6·6	25·35	....	..
Check	1908	2,416	....	....	..	..	....	....	..
4. Malbeck	1908	5,101	....	....	..	..	....	....	..
	1909	.	27·	28·5	68	5·	22·65	....	..
	1910	3,651	26·	27·	73	4·5	27·50	....	..
Check	1908	2,416	....	....	..	..	....	....	..
5. Mammolo	1908	4,296	30	29·	63	7·4	25·61	12·10	13·51
	1909	... .	26·5	27·5	68	5·4	25·15	12·36	12·79
	1910	5,951	24·	25·	73	5·2	24·76	....	
Check	1908	4,188	30·	28·	66	4·8	28·73	13·64	15·09
7. Muscat de Frontignac	1908	4,296	....	...	..	.	..	....	..
	1909	. ..	31·	32·5	68	4·8	31·04	15·40	15·64
	1910	3,759	28·	29·5	73	6·1	29·58	....	..
Check	1908	3,222	. ..	....	..	..	.. .	....	..
8. Verdot	1908	3,490	29·	28·	65	6·2	24·06	12·32	12·34
	1909	. .	23·	24·	71	4·0	21·65	10 88	10·77
	1910	4,881	22·	23·	73	7·2	22·41	....	..
Check	1908	3,973	21·5	21·	63	6·7	18·58	9·24	9·34
9. Syrah	1908	3,401	35·	32·	65	7·9	30·08	15·40	14·68
	1909	. ..	30·	31·	71	9·1	28·18	14·61	13·57
	1910	6,175	30·	32·	72	8·1	30·42	...	..
Check	1908	3,759	35·	32·	66	7·	30 26	15·78	14·48
11. Verdelho	1908	4,296	32·	31·	73	7·4	29·88	15·00	14·88
	1909	....	25·	26·	73	7·	25·00	12·86	13·04
	1910	6,175	26·	27·	72	7·2	25·97	....	..
Check	1908	3,490	32·5	31·	73	6·6	30·10	15 00	15·10
12. Pedro Ximenes ..	1908	2,685	....	....	..	..	....	....	..
	1909	....	24·	25·	73	5·2	23·60	11·80	11·80
	1910	3,866	23·	23·5	72	5·8	22·81	....	..
Check	1908	3,060	....	....	..	..	....	....	..
13. Pinot Blanc	1908	4,564	....	....	..	..	....	....	..
	1909	....	29·	30·	73	5·3	20·90	14·63	15·27
	1910	5,907	25·	26·	72	6·5	24·95	....	..
Check	1908	2,685	....	....	..	..	....	....	..
14. Shepherd's Riesling ..	1908	5,728	29·	28·	65	5·2	26·60	13·22	13·38
	1909	....	27·	28·	73	5·4	26·20	13·27	12·93
	1910	7,088	25·	26·	72	6·2	25·35	....	..
Check	1908	3,605	28·	27·	65	4·2	25·40	12·58	12·82
15. Riesling	1908	6,981	....	....	..	..	....	....	..
	1909	... .	20·	20·	68	9·0	19·40	9·09	10·31
	1910	4,698	20·	21·	72	6·3	19·64	....	..
Check	1908	2,865	....	.. .	..	..	....	....	..
16. White Shiraz	1908	4,833	25·5	25·	65	6·1	24·48	11·74	12·69
	1909	....	21·	21·25	68	7·2	20·60	9·63	10·97
	1910	7,356	20·	21·	73	6·5	19 64	....	..
Check	1908	8,114	20·5	20·	65	5·7	19·05	9·10	9·04
19. Tokay	1908	2,148	....	....	..	..	....	....	..
	1909	....	24·	24·	68	5·5	22·70	11·13	11·57
	1910	4,057	21·	21·5	73	4·5	22·03	....	..

(5) Grafted on Rupestris du Lot.

Variety.	Season.	Weight of Crop per acre.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit).	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
		lb.			°				
1. Aleatico	1908	2,506	31·	30·	66	5·5	26·74	13·20	13·54
	1909	....	28.	29.	70	6 3	25·15	12·06	13·09
	1910	3,515	28·	29·	75	6·2	27·30	....	..
Check	1908	..	29 5	28·5	68	5·3	26·74	13·12	13·62
2. Cabernet	1908	2,685	31·5	30·	70	6·2	28·56	13·68	14·88
	1909	..	28·5	29·5	66	6·5	27·24	13 15	14·09
	1910	2,577	28·	29·	75	6 3	26·84	....	..
Check	1908	4,564	32·5	31·	70	7 1	29·88	14·34	15·54
3. Lambrusquat	1908	2,416	28·5	27·5	70	4·3	26·20	13·20	13·
	1909	....	26·	27·	66	5·2	26·08	12·24	13·84
	1910	3,490	21.	22.	75	5·7	20·44	....	..
Check	1908	2,685	26·	25·	70	4·5	24·14	11·90	12·24
4. Malbeck	1908	. ..	26·5	25·5	68	4·2	23·69	12·18	11·51
	1909	.. .	27·	28·5	66	3·8	26 08	12 60	13·48
	1910	2,148	26·	27·	75	5·9	27·07	.. .	..
Check	1908	2,148	30·	29	70	3·3	28·40	14·42	13·98
5. Mammolo	1908	2,685	.. .	. ..	.	.	....	....	..
	1909	. ..	26·	27·	66	5·	23·58	11·05	12 53
	1910	4,654	23·	24·	75	4·7	24·76	....	..
Check	1908	2,416	....	....	.	..	....	....	..
7. Muscat de Frontignac	1908	2,953	30·	29·	68	5·8	25·52	12·32	13·20
	1909	..	31·	33·	70	4·9	28 48	14·02	14·46
	1910	5,012	24·	25·	75	6·5	24·76	....	..
Check	1908	2,148	34·	32·	68	6	31 80	15·54	16·26
Verdot	1908	5,370	26·	25·	67	4·8	24·78	12·12	12·66
	1909	....	28·	29·	70	4·5	25·54	12·64	12·90
	1910	5,531	19·	19·	75	7·4	18·92	.. .	..
Check	1908	3,938	25 5	24·5	68	4 3	25·44	12·50	12·94
9. Syrah	1908	3,222	29·	28·	64	6·4	25 04	12·56	12·84
	1909	....	33·5	36·	70	6·2	26·80	13·78	13 02
	1910	3,490	28·	29·	75	7·4	28·02	....	..
Check	1908	2,864	36·5	33·	64	6·9	31·08	16·26	15·54
11. Verdelho	1908	5,235	31·5	30·	68	6·7	31·59	16·88	14·71
	1909	...	28·	29·5	70	7·9	23·36	11·47	11·59
	1910	5,140	23·	24·	75	7·6	24 40	....	..
Check	1908	3,132	30·	29·	71	6·9	27·88	14·10	13·78
12. Pedro Ximenes.. .	1908	3,759	26·	25·	68	5·6	25·27	12 26	13·01
	1909	...	27·	28·	70	4 9	26·65	12·70	13·95
	1910	4,698	22·	23·	75	6·4	22·45	....	..
Check	1908	3,938	29·	28·	68	5·8	27·20	13·28	13·92
13. Pinot Blanc	1908	. ..	33·	31·	68	6·3	26·20	13·20	13·00
	1909	....	30·	31·5	70	5·5	25·71	12·17	13·54
	1910	3,222	25·	26·	75	6·5	24·63	....	..
Check	1908	2,416	31·	30·	68	5·7	24·90	12·30	12·60
14. Shepherd's Riesling ..	1908	3,087	27·5	26 5	70	4·8	25·62	12·80	12·82
	1909	....	32·	33·	70	4·6	26·65	13·37	13·28
	1910	4,697	28·	29·	75	4·8	27·77	....	..
Check	1908	4,430	30·	29·	70	4·1	28·72	13·96	14·76
15. Riesling	1908	3,222	27·	26·	71	5·7	26·46	12·76	13·70
	1909	....	26·	27·	70	5·7	24·36	11·66	12·70
	1910	2,608	25·	26·	75	5·1	23·84	....	..
Check	1908	2,953	26·	25·	71	6·4	23·26	10·98	12·28
16. White Shiraz	1908	9,129	25·5	24·5	72	5·3	22·84	10·6	12·24
	1909	....	21·5	22·5	72	6·9	21·88	10·06	11·82
	1910	6,688	20·	20·	75	6·8	19·81	....	..
Check	1908	7,518	21·	21·	72	5·1	20·71	9·84	10·87

(6) Grafted on Cabernet x Rupestris No. 33.

Variety.	Season.	Weight of Crop per acre.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit).	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
		lb.			°				
2. Cabernet	1909	....	28·	29·	65	6·5	25 28	12·60	12·68
	1910	4,051	27·	28·5	72	7·8	26·62	....	.
4. Malbeck	1909	...	28	29·	65	4·7	27·24	13·52	13·72
	1910	6,248	24·	25·	72	4·9	24·76	....	.
7. Muscat de Frontignac..	1909	....	32·	33·	65	5·9	31·24	15·60	15·64
	1910	6,199	24·	25·	72	6·	25·15	....	.
9. Syrah	1909	...	30·	31·	65	6·9	28·20	14·42	13·78
	1910	6,904	26·	27·5	72	5·2	26·18	....	..
11. Verdelho	1909	....	27·5	29·	65	6·4	25·68	12·74	12·94
	1910	1,611	26·	27·5	72	6 6	28·01	..	..
12. Pedro Ximenes.. ..	1909	....	23·5	25·	65	5·9	23·60	11·78	11·82
	1910	7,810	22·	23·	72	5·7	24 02	...	..
13. Pinot Blanc	1909	....	30·	31·	65	5·2	26·22	12·84	13·38
	1910	4,564	28·	29·	72	6·3	29·04	....	..
14. Shepherd's Riesling ..	1909	....	27·5	28·75	65	5·9	26·08	12·98	13·10
	1910	5,272	26·	27·	72	5·2	27·30	....	..
15 Riesling	1909	....	24·	25·	65	7·7	22·56	10·91	11·65
	1910	3,154	23·	24·	72	6·1	25·35	....	..
19. Tokay	1910	..	23·	24·	72	4·2	23·66	. .	..

(7) Grafted on Mourvèdre x Rupestris No. 1,202.

Variety.	Season.	Weight of Crop per acre.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit.)	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
		lb.			°				
2. Cabernet	1908	....	31·	30·	71	8·2	25·92	12·92	13·00
	1909	....	26·5	27 5	68	6·6	24·36	12·10	12·26
	1910	3,624	28·	29·	75	6·6	27·77	....	..
4. Malbeck	1909	....	25·	25·5	68	3·9	24·04	11·73	12·31
	1910	4,892	22·	23·	73	4·5	23·64	....	..
7. Muscat de Frontignac..	1909	....	28·	29·	68	..	25·95	12·70	13·25
	1910	3,452	23·5	24·5	73	5·7	25·15	....	..
9. Syrah	1908	....	30·	29·	71	7·5	26·06	12·82	13·24
	1909	....	26·	28·	68	8·2	25·15	12·63	12·52
	1910	4,618	28·	29·	73	7·5	27·30	...	..
11. Verdelho	1908	....	24·	23·	70	4·8	21·18	10·06	11·12
	1909	...	24·5	26·	66	6·7	23·13	11·40	11·73
	1910	2,864	27·	28·	73	6·9	27·30	....	..
12. Pedro Ximenes ..	1908	....	23·5	23·	70	7·9	20·71	9·88	10·83
	1909	...	25·	26·	66	5·5	23·92	11·78	12·14
	1910	6,203	24·5	25·5	73	5·5	24·76	....	..
13. Pinot Blanc	1909	....	25·5	26·5	66	6·	23·92	11·31	12·61
	1910	3,624	24·5	26·5	72	7·2	23·62	....	..
14. Shepherd's Riesling ..	1909	....	22·	23·	66	7·	20·55	9·93	10·62
	1910	6,248	22·	23·	72	6·6	21·47	....	..
15. Riesling	1909	....	22·	22·5	66	8·7	20·21	9·72	10·40
	1910	3,346	23·	23·75	72	7·2	22·50	....	..
19. Tokay	1909	....	24·	24·75	66	4·8	21·26	10 51	10·75
	1910	4,588	25·	26·	72	4·7	25·76	....	..

(8) Grafted on Rupestris Martin.

Variety.	Season.	Guyot's Saccharometer.	Keene's Saccharometer.	Temperature (Fahrenheit).	Acidity per thousand as Tartaric Acid	Sugar per cent. by Fehling's Liquor.	Dextrose.	Fructose.
				°				
2. Cabernet	1909	28·	29·5	65	6·6	27·04	13·56	13 48
4. Malbeck	1908	29·	28·	75	4·6	27·62	13·76	13·86
	1909	27·	28·	65	4·1	25·02	12·45	12 57
7. Muscat de Frontignac	1908	35·	32·	75	6·	30·82	15 12	15·70
	1909	28·	30·	65	5·3	28·51	13·71	14 80
Check	1908	36·	33·	75	5·1	34·62	17 00	17·62
9. Syrah	1909	28·	29·25	65	7·0	25·00	12·92	12·98
11. Verdelho	1908	34·	32·	70	7·	27·03	13 68	13·35
	1909	27·	28·	68	7·5	24·70	12·55	12·15
Check	1908	30·5	29·	70	5·7	29·16	14·78	14·38
12. Pedro Ximenes .. .	1908	25 5	25	75	5·8	22·04	10·86	11·24
	1909	26·	27·	68	5 5	24·04	11·93	12·11
Check	1908	29·5	29·	70	5·8	26 51	13·14	13·37
13. Pinot Blanc .. .	1908	31·5	30·5	71	7·3	25·40	12·46	12 94
	1909	28·	30·	69	5·8	26·22	12·77	13·45
Check	1908	29·	28·	71	5·5	26·70	12·74	13·66
14. Shepherd's Riesling ..	1908	22·	21·5	71	5 1	19·44	9·40	10·04
	1909	27·	28·5	66	4 9	26·71	13·21	13·50
Check	1908	26 5	26·	71	4·9	24·45	11·82	12·63
15. Riesling	1908	27·5	27·	71	6·6	23·54	11·80	11·74
	1909	26·	27·	66	6·9	24 92	12·18	12 74
Check	1908	27·	26·	71	7·	26·46	12 96	13·50
19. Tokay	1908	28·	27·	71	4 6	26·88	12·92	13·96
	1909	26·	27·	66	4·3	24·92	12·53	12·39
Check	1908	32·	31·	71	4·6	29·22	14·28	14·94

(9) Grafted on Rupestris Ganzin No. 1.

Variety.	Season	Guyot's Saccharo-meter.	Keene's Saccharo-meter.	Tempera-ture (Fahrenheit)	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.
				°		
Aleatico	1910	22·	23·	72	6·3	23·14
Pedro Ximenes	1910	22·	23·	72	5·8	23·32
Muscat de Frontignac ..	1910	24·	25·	72	6·4	24·20

(10) Grafted on Riparia Grand Glabre.

Variety.	Season.	Guyot's Saccharo-meter.	Keene's Saccharo-meter.	Tempera-ture (Fahrenheit)	Acidity per thousand as Tartaric Acid.	Sugar per cent. by Fehling's Liquor.
				°		
Mammolo	1910	22·	23·	72	4·7	23·00
Pinot Blanc	1910	22·	23·	72	6·4	23·14
White Shiraz	1910	20·5	21·	72	4·7	22·18

Turkeys: In Health and Disease.

[Continued from page 800.]

G. BRADSHAW AND A. L. WYNDHAM.

Turkeys at Wagga Experiment Farm.

THE climatic conditions at Wagga Experiment Farm are favourable to the successful raising of turkeys, and much information has been gained there from experience with the American Bronze variety.

Fig. 1.—Well Barred Wing (not fully Moulted).

The flock roam at will from sunrise to sunset, but are shut in a netted yard at night, to protect them from foxes, and also to keep them under control. They roost in the open air in all weathers—on the No. 8 wire on top of a 9-feet wire-netting fence, or on a stunted apple-tree in the yard. The larger birds are enticed to camp on the ground during summer, when the ground is hard, by strawing part of the yard. This prevents sore feet. The yard is cleaned up at least once a week, and the roosts sprayed with pheynol solution or sheep-dip, say, once a month.

The Gobbler.

We prefer a gobbler about 30 lb. weight for breeding purposes, with a good thick shank, not short enough to make the bird appear squat, nor so long that he has a stilty appearance. The gobbler should tread fully, with toes well spread. A bird appearing to walk on the ends of his toes will very often give you progeny with foot troubles. The mouth should be free from all growths; wing-flights well and evenly barred (Fig. 1); and head, neck, and tail in proportion to body. A good breast, with straight breast-bone, is of first importance. Gobblers true to colour are the rule where the flock are pure bred on both sides. Some slight deterioration may be noticed in the barring of wing-flights (Fig. 2) and in the colour of tail feathers, but this is

often righted in the second year. Gobblers with any true red feathers anywhere should be avoided where colour is being bred for.

They are fit for breeding purposes at 8 to 9 months of age, but are best in their second year. We have used a gobbler here 5½ years of age for breeding purposes; but our general plan is to change all our gobblers every second year. They need their spurs trimmed or blunted during breeding season; otherwise they will tear the backs of the hens. It is a good plan occasionally to lightly oil places attacked with lice.

The Hen.

Figure 3 represents two typical hens, weighing 17 lb. each. The bird on the right has the best plumage and most symmetrical outline, but lacks the tassel on the breast which the other hen possesses, and which is carried for three generations after the cross with the American Wild Turkey. We would also expect the progeny of the bird on the left to attain greater size. With our light feeding at Wagga, a hen with extra large frame is required to provide standard weight.

Fig. 2.—Deterioration in Barring in a Young Bird.

The young hens kept for breeding may run with the flock, as they do not lay much before 12 months old, and their first few eggs are not set.

Feeding.

The feed supplied to the breeding flock at Wagga consists of a small amount of wheat at evening for the greater part of the year, and practically nothing whilst stacking and threshing operations are being carried on anywhere near at hand. The wheat is soaked in cold water for twenty four hours before feeding during summer. Before laying is in full swing, and during autumn, soft food is supplied in the morning, at the rate of a kerosene-tinful to 100 head. This food consists of equal parts of pollard and bran, mixed rather moist with water or soup; or bread scraps soaked in water or soup all night, and mixed with about equal parts of bran. Green cut bone is also supplied twice a week, but only once a week during the breeding season. A large amount of lime is required for best results with turkeys, and at Wagga this is found the best way to supply it.

The turkeys are left to provide green food for themselves. Douglas' Mixture has its value, supplied during summer. It is composed of 1 lb. sulphate of iron, dissolved in 1 gallon of water, with 1½ oz. sulphuric acid. A tablespoonful is put in each gallon of drinking water.

The feed is all supplied in boxes, troughs, or shutes of galvanized iron, which are scalded at least once a week.

Broken oyster shell is always kept available. Shell of some other kind or waste mortar may be used as a substitute, or a small amount of lime may be added to the drinking water. Broken crockery is useful as a grit, but it is hardly necessary when the birds can obtain gravel while out. The use of warm feed during winter should be avoided as much as possible; and the same applies to rich forcing food, spices, and pepper.

Laying.

The smaller hens usually lay 12 to 17 eggs in a sitting; the heavier birds, 9 to 12. The eggs of the larger birds are usually of greater size. Most of the eggs have an individual colouring on the shell, which allows of their being identified.

The hens may be enticed to lay near at home by putting heaps of bushes about. They do not seem to like boxes. Stacks of hay, &c., have a great attraction for them.

Keeping turkeys in to lay seems of little use; but a bird may generally be depended upon to return to last season's nest. They give ample warning of their intention to lay by uttering a peculiar cry; but it is hopeless to follow them to see where the eggs will be deposited. The laying takes place at any time during the day.

With regard to laying season, at Wagga a small clutch have been hatched in June, and the settings have been fairly numerous in July some years ago; but, in 1909, it was not until September that any poults were hatched, the settings being continued well into November. The birds hatched in December, however, were backward in growth. The actual laying, in decreasing numbers, went on until February, 1910, when some eggs were set, but they proved infertile.

Mating and Breeding.

One service of the gobbler is sufficient for each setting of eggs, and a single male is generally sufficient to keep with 15 to 20 hens. But their tendency to become lazy, or the chance of sickness or accident during the breeding season, when it is hard to secure another suitable bird quickly, makes it advisable to have two birds on hand where more than 10 hens are kept. Particular matings are secured by letting one gobbler out with the flock at a time, penning the other gobblers. This plan is also followed with new birds.

The gobbler has the bigger influence on colour and shape of the progeny, but large hens are needed to produce big turkeys.

Hatching.

Settings of turkey eggs sent away by post hatch better some years than others. The settings received in this manner should be given twenty-four

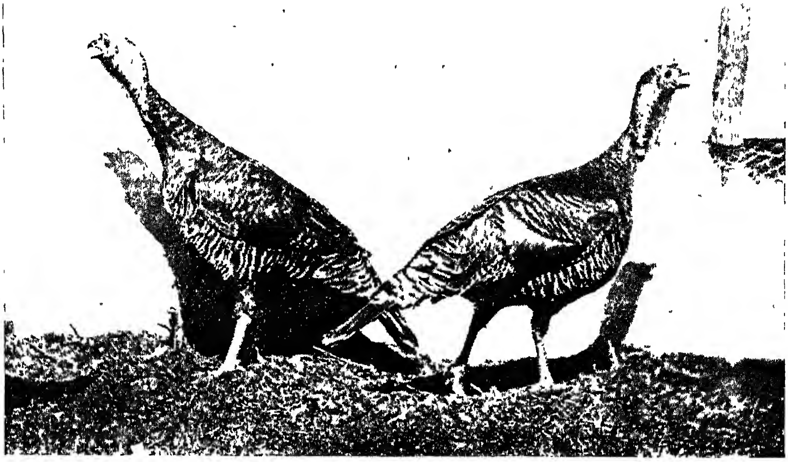


Fig. 3.—Bronze Turkey Hens, Wagga Experiment Farm.

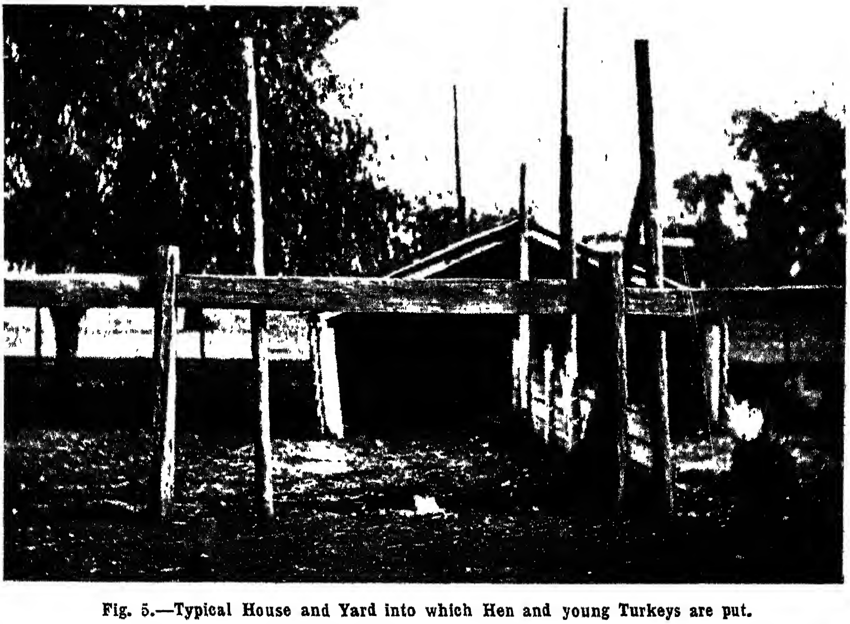


Fig. 5.—Typical House and Yard into which Hen and young Turkeys are put.

hours' rest before being put under hen or into incubator. The eggs should not be washed before setting, though it is safe enough to wash them during setting if required. The settings given to turkey hens to hatch last season at Wagga numbered 14, totalling 139 eggs, including 48 eggs set early in the year, which all proved infertile. The total number hatched was 33. Put into incubators, 117 eggs resulted in 69 poults. The general average hatching was 40 per cent. of eggs set, or, not including the early infertile eggs, 50 per cent. The incubators were used when no hens were broody.

As a general rule, hens allowed to sit on nests selected by themselves do not hatch as well as on nests prepared for them. At Wagga the nests are made at the bottom of straw stacks, so that the eggs may be on the earth. The straw is pulled out or cut out, to make a hole about 18 inches high, 3 feet long, and 2 feet deep. The earth is worked up a little, and a board screen provided to fit in closely. Broody turkeys may generally be shifted to these nests during the daytime. It is best not to put in the eggs for setting at first, but to give two or three hen eggs or infertile turkey eggs for the first few days.

Shutting sitting hens on the nest is necessary to prevent other turkeys from fighting them to lay there, and also for protection at night time. They are put off their nests every other day, and provided with food. A little grain and water is given to them by themselves, but they partake of very little.

No methods are adopted to make the hens sit; but having the nests too low to permit of their standing upright in them will often make a partially broody turkey sit.

Clucky hens may be distinguised by the extra redness of shanks, bareness of breast, running instead of walking, and other turkeys chasing them.

Testing for fertility should be done on the seventh day, using a leather tester in the sunlight, as shown in Figure 4, when the contents of the eggs may be plainly seen. The period for hatching turkey eggs is four weeks, but is liable to be less in extra dry weather. One case occurred at Wagga where the poults appeared at the end of the third week. Good results accrued from moistening the earth around the nest several times with cold water during the month of November, 1909.

When the turkey hen is due to hatch, the nest should be visited at intervals, and the poults removed as

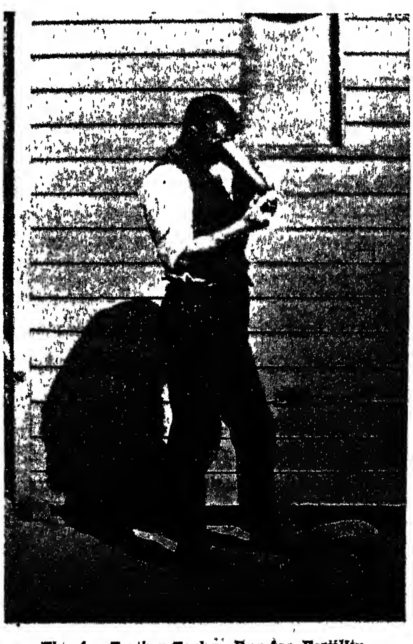


Fig. 4.—Testing Turkey Egg for Fertility.

they dry. If this is not done the hens generally become restless and try to leave the nest. The young birds may be safely kept in any warm place till the hatch is complete, and then returned to the mother. The common fowl has been occasionally used for hatching turkey eggs at Wagga, and for the part-raising of poults, but not satisfactorily. Fowls give the poults too much warmth, continually taking them under their wings. The fowl's movements are also much too quick for the poults, and she scratches up the ground, knocking the young turkeys over in all directions.

Rearing and Feeding Poults.

The poults hatched in incubators at Wagga last season were given to turkey hens to rear, these hens having been kept waiting for them a few days on individual nests, covering infertile eggs from the incubators or other settings. The turkey chicks were given to these hens in the warmth of the day; and only in one case was there a refusal to mother them. The turkey and her brood should not be cooped at all, as better results are obtained by putting them into a shed in an empty yard (Fig. 5). If the hen appears to want to leave the chicks, shut them in the shed until she settles down. The turkey may be allowed to camp outside the shed the first night if she wants to, but the corners of the yard and all holes should be filled in to prevent her taking her chicks anywhere where they might be injured by floodwater from a storm. They are confined to the yard for two or three days, and then let out in the open as much as possible, even on damp days, provided the grass is not long. They should only be shut in the house during rainy weather; at other times they may be allowed to go in as they want to.

While young (say for three weeks) they are brought back for feed and water at midday. Being out all day seems too hard for young poults, though the turkey hens do not appear to think of bringing them back until about 4 o'clock if left alone. They travel considerable distances during the day, often several miles, halting about 10 o'clock on hot days under shade, but keeping continuously on the move on cool days. The young flock generally make for the same place for some time, but are largely influenced by any wind that is blowing, choosing to go against it and circle home. Travelling with the wind blows the young chicks' wings out, which annoys them.

Plenty of exercise is necessary for young turkeys, and though following the method mentioned entails a lot of walking, it is always carried out at Wagga Farm.

The young birds are very foolish with wire-netting, and get confused, walking up and down till they drop. Closely-panelled fencing has the same effect, and even the older birds often get stuck. They also get into enclosures by flying, but never think of getting out the same way.

It is best for the poults to have two or more turkey hens with them when out; they are safer from the attacks of crows, hawks, &c. One hen will cover them while the other fights. The hens will also give snakes and iguanas a bad time.

Any batches of turkeys with, say, more than a week's difference in their ages, are best kept apart till the younger ones get strong.

The most successful feeding for poults at Wagga has been coarse oatmeal, or pollard and bran, just sufficiently moistened with water or milk to slightly adhere; together with curdled milk as available for the first four days. Then small-ground grains or pollard and bran may be given as before, but mixed moister as the birds grow. Turkeys do not take readily to any change of food. The use of milk is strongly advocated, in any form and at all ages.

Full grain is often eaten by turkey chicks at an early age; but it is not advisable to give it until after the third week, when it should be soaked in cold water for twenty-four hours beforehand.

Meat food in some form is necessary. Green bone is supplied at Wagga in small quantities daily after the first week. Should it not be obtainable, a plentiful supply of broken shell of some kind should be within their reach, or small quantities of unslacked lime put in the drinking water.

Four feeds a day are necessary in the early stages; then three a day till full grown. Dead-wood charcoal in small pieces should be available. The drinking water should be clean and cool, and provided in shallow tins; otherwise the young turkeys will drown themselves. The hens never take them near any sheet of water while young. The water may be medicated once a week after the first week with Epsom salts and permanganate of potash to advantage, or at any time the young birds are ailing. Individual dosing with young birds is not a success.

Bicarbonate of soda will be given in small quantities in the drinking water to the young turkeys at Wagga for the first week this year. It has been found valuable to fowls' chickens in the early stages.

The period when the chicks require the mother turkey's assistance is marked as ended when red appears on their heads and necks. The old turkey will then be found enticing them on to high roosts; but the hens are very faithful, remaining with their broods till they are grown up, unless it is early in the season, and they sit again. At Wagga, 81 poults have been raised out of 101 hatched.

Marketing.

The average weight of young gobblers despatched from Wagga Farm this year was 23 lb. each. They were birds hatched in September, October, and November of the previous year. The loss in dressing such birds for table is recorded as 6 lb. each. The loss of weight in travelling alive is about 3 lb. each. The method of despatch is by home-made crates—height, 26 inches; length, 33 inches; width, 21 inches; weight, 20 lb. They are made as follows:—Floor, $3\frac{1}{2}$ pieces 6-inch dressed pine; uprights, 4 pieces 6 inches, sawn in half; sides and stays, 6 pieces 6 inches, sawn in half; end pieces, 4 pieces softwood, 2 inches x 1 inch. Door on top, lined with hessian, and covered with $\frac{1}{2}$-inch mesh wire-netting.

The proper method of catching a turkey is by the leg; avoid handling them as much as possible. The best way to carry them is shown on page 798 of the September, 1910, *Gazette.*

Preservation of Eggs by Coating with Paraffin.

(From the Government Bureau of Microbiology, Sydney.)

It has been suggested (reference mislaid) that eggs might be preserved by sealing the pores in the shell, and so preventing evaporation on the one hand and the entrance of putrefactive bacteria on the other. Experiments to test this point were begun in the Bureau of Microbiology, Sydney, in June, 1909, and the results determined in June, 1910. Thanks to the courtesy of the Principal (Mr. H. W. Potts), fresh eggs were obtained from the Hawkesbury Agricultural College, and on receipt placed in an airtight apparatus in a warmed solution of the sealing mixtures to be mentioned below. By means of a suction pump the apparatus was exhausted of air, and, incidentally, the eggs were made to part with any air that had penetrated into the shell, and which escaped as a stream of small bubbles. On the suction being discontinued the sealing fluids could penetrate through the pores and take the place previously occupied by the air. In this way they sealed the pores and formed a fine layer over the shell of the egg. All this was accomplished in a few minutes, and when finished the eggs were lifted out, allowed to dry, and stored.

The sealing solutions used were (*a*) gelatine, and (*b*) a mixture of paraffin and vaseline. Along with the eggs treated by these substances there were also stored some untreated eggs as controls. All three varieties were examined a little over twelve months after the experiment was commenced. It was found that some of the control eggs had become putrid, but most of them had become quite dry by evaporation. The eggs treated with gelatine were not well preserved, and had evaporated to a large extent, so that this process was not effective. The paraffin-treated eggs, however, had neither evaporated nor decomposed: the results in this case were decidedly good. The white was quite fluid, perhaps even more so than normal, and although the yoke membrane was easily ruptured, in most instances the yolk was turned out in an unbroken state. When boiled, these eggs had a distinctly "old" taste, but were otherwise satisfactory. The taste referred to is probably inseparable from the long keeping of eggs; it is not due to decay but to internal changes of the egg substance.

It is to be noted that after treatment no particular care was taken of the paraffin-treated eggs, and probably they would stand handling in the ordinary way in the course of business. They are clean and dry, and could be used for culinary purposes. It is possible that the process might be usefully employed to protect eggs which have to be sent to a distance or exported.

The Microbe of Contagious Abortion in Cows.

FRANK TIDSWELL, M.B., Ch.M., D.P.H., Director, Government Bureau of Microbiology.

Abortion—slipping of the young—is not infrequent in different species of animals. It is said to be common in mares, less common in ewes, exceptional in sows and goats; very rare, indeed, in dogs or cats. But of all the domestic animals, it is especially observed in cows.

It is admitted that abortion is not always due to contagious disease. It can occur as the result of mischance—wounds or other injuries to the mother, or death of the fœtus—and of ordinary febrile diseases of the cow. In this case the occurrence of abortion is sporadic, in the sense that it affects an individual here and there, and does not spread from the animal to others in contact with it. But over and above this kind of abortion there is a form which does depend on infection or contagion, and which occurs in outbreaks, attacking many members of the herd simultaneously or in succession, and which spreads from infected animals to healthy ones.

The original evidence of its existence was obtained by Franck, who produced abortion in a healthy cow by depositing in her vagina fragments of the after-birth of another cow which had aborted. Lehnert (1878), Bräuer (1880), Trinchera (1888), repeated and confirmed these observations, and in 1886 similar work was done by the Highland and Agricultural Society in Scotland.[1] A further advance was made by the distinguished French veterinary surgeon Nocard, who showed that the fœtus and its membranes were invaded by a microbe which produced an inflammatory condition (to be described below) likely to cause the abortion. Finally, Professor Bang, of Copenhagen, published a work which confirmed the observations of Nocard, and which further reported the isolation of the microbe into pure culture, and the production of abortion by deposition of the culture in the genital passages of pregnant cows.[2] According to Ostertag,[3] the infectious abortions of cattle and horses are both due to the same microbe. It is not clear that it is also responsible for abortion in ewes and goats, but it is certain that it can be made to cause abortion in these animals if artificially introduced.

Outbreaks of this kind have been recorded at all times in all countries, and would appear to be not uncommon in Australasia. It has been the subject of repeated reports by the Veterinary Department of New Zealand,[4] and of various references in the *Agricultural Gazette* of New South Wales,[5] and

[1] Nocard et Leclainche, *Maladies microbiennes des Animaux*, 1903, Tome II, p. 400.
[2] Bang, *Die Aetiologie des seuchenhaften Verwerfens.* Zeit. f. Tiermed. 1897. Ref. Kolle & Wassermann: Nocard & Leclainche.
[3] Ostertag, *Seuchenhaften Abortus*, in Kolle & Wassermann, *Handbuch der Path. Mikroorganismen.* Bd. III, p. 827, 1903.
[4] N.Z. Dept. of Agric. Divn. of Vet. Science.
[5] *Agric. Gazette*, N.S.W. Vol. IX, 1898. Vol. XX, 1909.

pamphlets have been issued which briefly indicate the nature of the disease and prescribe remedial measures. Recent inquiries suggested to me the desirability of issuing a more detailed description of the disease, and as I have not been able to find one in a form likely to be useful to stockowners in this State, I have prepared this summarised account of the views of authorities upon the nature of the microbe associated with Contagious Abortion (Epizootic Abortion). In submitting these data I assume that the contagious abortion in this country has the same cause as that in Europe and New Zealand. I have no reason to doubt the identity, but I am not in a position to vouch for it, since so far my efforts to obtain specimens have been resultless. Perhaps the publication of this memorandum may obtain some assistance in this matter, and in any case I shall be glad to receive nformation on the subject for inclusion in future reports.

Characters of the Disease.

Contagious abortion in the cow is said to be rare before the third month of gestation, but after this, may occur at any period. A cow about to abort preserves all the appearances of health; as a rule, no symptoms sufficient to attract attention are exhibited. Occasionally local swellings, evidences of uneasiness, and attempts to apparently prepare for calving may be observed, but generally the event occurs with no premonition to the owner. The expulsion occurs easily. There is neither colic, nor violent efforts. The cow does not cease to eat or to ruminate. If the fœtus is very young it issues with its envelopes intact. At a later stage the membranes burst in the usual way, but instead of being expelled after the calf they are most often retained, wholly or in part. They then undergo putrefaction *in situ*, and there is a putrid discharge from the vagina. The calf is generally dead. After the sixth month it may arrive living, but only survives a few hours; even when towards the end of gestation, and apparently vigorous in appearance, it ceases to suck after a few days, develops diarrhœa and dies. Occasional survivors are very feeble, and have retarded growth.

Having once aborted, a cow is liable to do so again, or the abortion may be followed by sterility. This point, mentioned by Bang, has been much emphasised by Professor Gilruth in his various reports.[1] Cows which have aborted, he says, sometimes develop œstrum, or desire for the male, but although they return to the bull repeatedly they do not conceive. Presumably the condition of the womb prevents the retention of the ovum, and so the cow cannot become pregnant.

The condition of the womb referred to is one of chronic inflammation (endometritis). In the womb of a pregnant cow the young calf lies in a bag of membranes. These membranes normally are in close contact with the womb of the mother, and the calf is nourished by nutritive fluids which pass from the blood vessels of the mother to those of the membranes, and from

[1] N.Z. Department of Agriculture, Division of Veterinary Science, Reports 1902–1907.

there reach the calf through the navel-string. When the microbe of contagious abortion gets the chance, it penetrates in between the membranes and the womb of the mother, and sets up inflammation. There follows a discharge which occupies the space between the membranes on the one hand and the womb on the other, and thus disturbs their normal relationships; separates them more or less, and so induces abortion. The inflammation, started in the way mentioned, and encouraged by the putrefaction of the after-birth, persists in a chronic form for months or years, and prevents further conception, or, if conception occurs, again gives rise to abortion.

Those who care for further details may be interested in the following pathological account of the condition:—

In animals which have calved in consequence of infectious abortion, one finds œdematous infiltration of the connective tissue between the chorion and allantois, with difficult delivery of the after-birth and muco-purulent discharge after the birth. Nocard reported that at the site of the cotyledons the central villi are thickened, dirty white, and as if infiltrated by pus or macerated; a quantity of yellowish granules of puriform matter cover the base and sides of the pedicles. The cotyledon, deprived of its placental sheath, is firm and red; pressure forces out drops of a purulent appearance. The puriform granules, the juice of the cotyledons, and scrapings of the uterine mucous membrane enclose short, fairly-thick bacilli (and micrococci), isolated or associated in short chains. Similar microbes are to be found in most of the abortions. Bang found the alterations of the uterus and placenta reported by Nocard. There exists at the surface of the uterine mucosa an abundant exudate formed of mucus and little greyish-white granules. Histological examination showed pus cells and cellular débris. The sub-chorial conjunctive tissue is the site of a very marked œdematous infiltration. The uterine exudate contains in abundance a fine bacterium, which may be found in pure culture if the examination is practised with a primipara before the death of the fœtus. Observations showed that these microbes ought to be considered as the essential agent of the abortion.

Bang gives the following description of the pathological changes, as seen in a cow slaughtered soon after the appearance of the early symptoms. The animal was 5 years old, had been covered by the bull on May 21st, and showed the first signs of abortion on 15th December. She was slaughtered and examined on 19th December.

The outer side of the uterus was normal, the orifice closed, and the canal of the cervix full of normal mucus. After disinfection of the serosa by searing, a section was made through the uterine wall. Between the mucous membrane and the fœtus there showed itself a rich exudation of a dirty yellow colour, and showing shiny clumps. In some places the exudate had a half solid character; the reaction was alkaline. On standing in a glass, there was a division into two layers, above, a reddish-yellow serum, and underneath a thick, dirty greyish-yellow deposit. By section of the chorion, one saw under it a thin, clear, apparently gelatinous substance, which consisted of an œdematous exudation into the fine connective tissue lying between the chorion and the allantois. This œdema was spread over the whole fœtus, and formed a layer about 1·5 cm. thick. The allantoic fluid was of natural appearance. Nothing unusual in the amniotic fluid. The umbilical cord was thickened by œdema. The size and hairiness of the fœtus indicated an age of 7 months. It was perfectly fresh, and on section showed no apparent changes, except a little reddish serum in the pericardium. The intestinal mucous membrane was probably a little redder than usual. The spleen slightly swollen, and the blood fluid. (1.)

From the foregoing and similar researches it was concluded that the infectious abortion of cows is due to a specific catarrh of the uterine mucous membrane, which loosens the connection of the uterine envelopes with the uterus, and so causes destruction of the fœtus, which is then expelled. The expulsion of the fœtus is not followed by a normal expulsion of the after-birth, such as occurs at full-time; the after-birth comes away in

(1.) From Kolle and Wassermann, *Handbuch der Path. Micro-organismen*, Band III, 1903, p. 833.

pieces, bit by bit, and is accompanied and followed, for a variable time, by a discharge from the cow, due to continuing inflammation of the womb. This discharge, as well as that originally occurring between the membranes, contains the microbes responsible for the illness. They are to be found also on and in a prematurely-born calf.

Characters of the Microbe.

The Bacillus of Contagious Abortion (Bang), as the microbe is called, has some very distinctive characters, which are here described for the information of those desirous of knowing such details :-

In cover glass preparations of the yellowish exudate from the uterine mucous membrane and the fœtus, there are to be seen very small microbes, often apparently in pure culture. Under strong magnification they appear as bacilli of variable dimensions. Some are as long as the tubercle bacillus; others are shorter, and show two or three rounded or elongated granules which may look like ovoid micrococci. These are doubtless the forms which Nocard took for micrococci in short chains. The microbe is non-motile. It stains well with aniline colours, not by Gram.

The cultures are characteristic. On gelatine agar, there is no growth. In pure fluid serum there is a scanty growth. In bouillon, with 5 per cent. glycerine, there occurs turbidity and growth after fourteen days as a fine scanty deposit, which contains some small whitish granules, consisting of colonies of the abortion bacillus. Whilst the growth is thus slight on each one of these culture media, it becomes definite in a mixture of them. This mixture, as recommended by Bang, consists of peptone-bouillon with ·75 per cent. agar and 5 per cent. gelatine, cooled to 45° C., and mixed with an equal volume of sterile serum. The material (vaginal exudate) is inoculated into the liquid; a series of dilutions made; the tubes cooled under tap, and allowed to set. The growth appears in the form of small colonies which grow only in a special zone of the culture tube. This zone lies about ·5 cm. under the surface of the nutrient medium, and has a breadth from 1 to 1·5 cm. The abortion bacilli do not grow either above or below this zone.

Upon this point Bang and Stribolt have made some interesting observations. Bang proved that as regards aeration there are two optima, namely, an atmosphere containing less oxygen than ordinary air, and, secondly, one containing a much higher proportion of oxygen. Between these two optima there is an intermediary zone in which the abortion bacillus develops little or not at all. Stribolt found the bacilli grew on the surface of agar serum in an atmosphere of oxygen, and in glycerine bouillon, through which he allowed oxygen to stream freely, then closing the flask neck with paraffin. The addition of 4 or 5 per cent. carbon dioxide to the oxygen did not alter Stribolt's results. Thus, whilst the bacilli will not bear concentration of oxygen such as exists in ordinary atmospheric air (21 per cent.), on the other hand they grow well in an oxygen-rich atmosphere. There is thus a microbe which is neither aerobic nor anaerobic in the ordinary sense.

Bang proved that the microbe just described was the cause of the complaint, by experiments on animals with pure cultures of the bacillus. Three cows inoculated per vaginam with cultures aborted, and the discharge contained the microbes in abundance. Abortion was similarly induced in ewes and in a mare.

The bacillus is said to be constantly present in the discharge from affected cows. It has been found in the calf. In both the womb and the calf it may be present for long periods. Bang found the bacilli in the uterus of cows which contained dead, mummified calves. On the 15th February, 1897, Stribolt post-mortemed a two-year-old heifer which had been covered by the bull on the 19th March, 1896. In the beginning of September she showed signs of abortion which, however, later disappeared; at the post-mortem of this otherwise apparently quite healthy heifer Stribolt

found a mummified fœtus in the uterus, and abortion bacilli in the yellow-brown exudate. Bang has shown that the abortion bacilli can remain five to nine months in the uterus, a discovery which explains why a cow which has once aborted tends to do so again.

Modes of Dissemination.

From what has been said above it follows that the discharge will be infectious, and will render infectious anything it touches. The cow herself, the calf, whether alive or dead, the litter, the stalls, the yards, and persons who handle the cow, may any of them become the means of conveying the disease to other cows. But of all such agencies the greatest stress is laid upon dissemination of the infection by bulls. Clearly, a bull which serves an infected cow may become contaminated, and experience has shown abundantly that the microbe survives upon him long enough to be transmitted to cows served afterwards. These bulls show no signs of being infectious; they are apparently perfectly healthy, acting merely as "carriers" of the microbe without being affected by it.

But whilst the disease is thus truly contagious, being conveyed directly from animal to animal, it appears also to be capable of being spread in other ways. There are instances in which contagion seems to be out of the question, and Nocard suggested that in such cases the disease might be acquired by inhalation or by feeding. In the case of the ordinary infection through the genital passages there was no difficulty in understanding how the microbes got into the womb: the way was directly open to them. But for infection to arise after inhaling or swallowing, the microbes would have to be taken up into the blood and then be carried to the womb. Bang's investigation of the point showed that this could occur. He first found that microbes injected into the blood vessels of pregnant ewes could afterwards be detected in the womb after the lambs were born: and in the womb there occurred the characteristic discharge already mentioned. He then injected into the jugular vein of a pregnant mare 25 c.c. of bouillon cultuie, and in twenty-nine days there was born a very small living foal, which died two days afterwards. Here, also, on the membranes was a considerable quantity of muco-purulent, thick exudate, containing masses of the abortion bacilli. Similarly he injected 36 c.c. of culture into the jugular vein of a four-year-old cow which was in the fourth month of pregnancy. Three months later it aborted, and the after-birth was covered with exudate containing abortion bacilli. Since that time similar experiments have been made with cows, sheep, goats, and rabbits. Animals so injected may have a little fever, but they soon recover; and if killed show no signs of disease except in the uterus, where alone apparently the bacilli find conditions suitable for their development.

These results show that the bacillus can be carried to the uterus through the blood. Hence it was possible that the pregnant animal could be infected through the alimentary canal. This was put to the test in the following experiments:—An eight-year-old cow, served March 14th, 1897, on a farm

where abortion did not exist, received ¾ litre of culture by mouth on 12th June; and on the 7th September, a good deal of exudate from an aborting cow. On the 26th November it bore a small living calf. The after-birth was covered with typical exudate, rich in bacilli. Another experiment was made on a heifer which had lived since her first days in Bang's laboratory, in stalls where aborting animals never came, and which had been served by a young bull which had been raised under just the same conditions. About three months after service the heifer was given three fœtal cotyledons from the after-birth of an aborting cow. Fifty-six days later the heifer aborted in the typical way, thus proving incontestibly that a pregnant cow may be infected by eating parts of the after-birth of an aborting animal. Bang maintains the view that cows as well as sheep and goats, are very easily infected in this way. He considers this fact to explain outbreaks where many cows are simultaneously attacked, and which are not accounted for by direct contagion. The infection in these cases is held to be conveyed through forage or by persons who handle it, or by small animals who carry it.

From what has been said above, it will be gathered that contagious abortion is the result of an insidious inflammation of the womb, which doubtless exists months before any symptoms appear. In experimental sheep or goats, abortion does not occur until from nine to twenty-one days after the introduction of the infectious material into the vagina; in experimental cattle the incubation period is said to be five to ten weeks. Under natural circumstances the incubation period seems to be even longer. In seven instances referred to by Bang it was ten weeks in five cases; three months in one; and four and a half months in the remaining case. During these periods the microbe is living in the womb and gradually producing there the diseased condition, which ultimately causes the abortion. It is, therefore, possible that the cow may be infectious during this period, or at all events during the latter part of it. It is stated that the catarrhal secretion which precedes the rejection of the fœtus has provoked abortion if introduced into the vagina of a healthy cow. After the abortion the cow remains infectious for a considerable time, and is certainly not safe while there is any discharge from her. As already stated, everything this discharge touches may become infectious. Notwithstanding that the microbe is pretty strictly parasitic, and flourishes only in the living body of its victim, it seems capable of surviving externally long enough to cause mischief. Discharge collected in glass tubes and placed in an ice chest contained living bacilli after seven months. The disease survives in certain regions, and in certain stables, and the cows from healthy places abort if taken into the affected places; and the malady may be imported into clean herds by animals derived from infected ones.

TREATMENT.

General Measures.

If the nature of the malady has been made clear by the above description, it will be readily understood that preservation of the herd from it, or the management of an infected herd, demands exacting care and watchfulness.

Cows, bulls, milkers, premises and pastures may any of them be the source of trouble. It is prudent not to introduce new cows until after a period of observation or until they have calved normally. A circumstance not to be forgotten is that a cow which has calved at full term may nevertheless be infective; abortion occasionally occurs late, and the calf may be carried to full term notwithstanding that the infection is in the uterus. The condition of the parts after calving should be carefully observed.

When an animal shows signs of aborting it should be put aside. The manure and all parts soiled by the excreta should be disinfected and, when possible, burnt. In order to prevent further spread and to protect against subsequent abortion and sterility, the cow, both before and after abortion, should be systematically treated with disinfectant, as described hereunder, until cessation of all discharge. Aborting cows should not be sold nor sent to the bull until so treated.

The calf and the after-birth, as well as litter or anything else soiled by the discharges, should be destroyed by burning whenever possible, or otherwise well treated with disinfectants. If the aborted calf is alive, it should be remembered that there may be abortion bacilli on the skin and in its fæces, and so it should be washed with disinfectant.

Any bull is likely to convey the microbes of the disease after recently serving a cow that has aborted, or one affected with the form of sterility caused by the disease. Hence, healthy bulls should not be allowed to serve infected cows, or they may become converted into carriers. Obviously, bulls from infected farms should not be allowed to serve healthy cows; not, at all events, until they have been disinfected as described below. The common use of a bull by several herds involves considerable risk.

It is also to be remembered that the disease may be spread by persons coming from an infected herd to a healthy one. Such persons may carry the infection on their clothes. Persons obliged to handle infected cows, &c., should do so after work with others is finished, and should wear special overalls during the process, and disinfect the hands, &c., afterwards.

The stalls should be kept as clean as possible; dejections removed night and morning, and the floors and walls washed with disinfectants at intervals. The yards, and all other places likely to have become contaminated, must be cleaned up and disinfected. Since Bang has now shown that infection is possible through feeding, it follows that the pastures upon which cattle have aborted may need to be avoided for a considerable time. The spot where the aborted calf has fallen should be burnt, and afterwards disinfected and dug up.

The outbreak of abortion should lead to the disinfection, as described below, of every cow in the herd, and of the bull. Professor Gilruth advises this general treatment when cows fail to conceive, and return to the bull at short intervals. Considering the important part he plays in disseminating the disease, it is evident that in every case the bull should be treated.

Local Treatment.

The following directions for local treatment are taken from "Leaflet for Farmers, No. 68," issued by the New Zealand Department of Agriculture, 1905; but similar directions are given in leaflet No 3, issued by the Stock Branch, Department of Agriculture, New South Wales[1]:—

Materials Required.

From our experience, the antiseptic drug which best combines efficiency with simplicity of application is mercuric chloride (corrosive sublimate). This drug is for such purposes as this put up in flat circular pellets, each containing a definite quantity (8·75 gr.) We have found the "soloids" prepared by Messrs. Burroughs, Wellcome and Co., to be undoubtedly reliable, having now despatched from this laboratory nearly a hundred thousand of these, and, up to the present, the few complaints we have received have been indubitably traced to improper or careless administration on the part of the operator.

In addition to the pellets of mercuric chloride, it it also necessary to be provided with a 3 feet length of thick indiarubber tubing of ½ inch diameter, and a small funnel, either of glass or enamelled metal.

Neither the drug nor its solution must on any account be allowed to come in contact with plain metal, on account of its strong chemical action on such material.

Also, for use in the treatment of the bull, an ordinary enamelled syringe with vulcanite fittings should be obtained.

The strength of the solution of mercuric chloride to be used is as follows:—

(*a*) For cows which are repeatedly returning to the bull, or are apparently sterile, 1 in 1,250.[2] This can be conveniently prepared by dissolving one pellet in an ordinary (clear glass) whisky-bottleful of water which has been boiled and allowed to cool to about blood-heat.

(*b*) For a bull a solution of the same strength (1 in 1,250) should be used.

(*c*) For cows which have just aborted, a weaker solution (1 in 2,500) should be used and applied once daily for three successive days, and at weekly intervals afterwards if there be any discharge from the vagina. This solution can be made by dissolving one pellet in *two* whisky-bottlefuls of water.

(*d*) For in-calf cows, more than three months pregnant, which are to be treated as a preventive measure, the solution 1 in 2,500, as in paragraph (*c*), should be used.

Unless in the case of an actually aborted cow, one application only is necessary if properly carried out.

The Method of Procedure in Treating Cows.

(1) Boil for five minutes the tube with the funnel inserted into one end, and then apply to the outside of the tube a dressing of salad oil or good lard.

(2) Wash the hands and arms thoroughly in hot water to which a disinfectant has been added.

(3) Place the free end of the piping by means of the hand gently into the womb (or, in the case of an in-calf or sterile cow, as far up the vagina as possible without undue force being used), taking care not to injure the lining membrane. During insertion the curve of the tubing is better turned downwards.

(4) Hold the outer end of the tubing, with the funnel, about 6 inches above the root of the cow's tail.

(5) Pour the solution of mercuric chloride as described gently into the funnel, and so thoroughly irrigate the parts. If the fluid does not run fairly freely from the tube, the inner end need only be moved gently to and fro to secure a free flow. The intention is to thoroughly irrigate every portion with the solution.

(6) Thoroughly wash down the parts from the root of the tail to the bottom of the udder with some of the same solution as that used for irrigating.

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[1] *Agricultural Gazette of N.S.W.*, vol. xx, 1909, p. 298.

[2] Bassi (*Il. moderno zooiatro*, 1896, p. 464) has shown that fecundation may occur in cows which are being subjected to antiseptic treatment.

The Method of Procedure in Treating a Bull.

Place the animal in a crush-pen, or otherwise secure him in such manner that he may be readily handled without danger. Then grasp the prepuce (or sheath) by the left hand and pass the nozzle of the syringe inside the sheath, afterwards holding it in position with the same hand. Then, with the right hand, pump into the sheath a quantity of the solution sufficient to irrigate the parts.

Note.

Be certain that the whole of the pellet is thoroughly dissolved before using the solution, as any undissolved particle lodging on the lining-membrane of the vagina, or womb, would cause intense irritation.

Caution.

In connection with this treatment it is necessary to remember that mercuric chloride is a highly poisonous drug if swallowed, and therefore every care should be exercised in order to prevent accidents.[1]

The treatment just described, though troublesome, is essential for the eradication of the disease, and it is effective. Safe disposal of the aborted fœtus, together with the membranes; careful local treatment of the cows, and of the bull; and thorough disinfection of the stalls, if carried out with perseverance, generally succeed in getting rid of the disease. Bang and Ostertag report that by these means they have controlled the disease where formerly it was regarded as incurable and affected entire cattle areas. The results may not be immediate, but the occurrences of abortion become more and more rare, and, as a general rule, disappear altogether in a year or two. The procedure has given good results in France, England, Italy, Bavaria, and Saxony.[2]

The Carbolic Acid Treatment.

Attempts are sometimes made to prevent or treat abortion by ordinary medicinal means. Bräuer,[3] who was one of the early investigators of the disease, recommended injection of 20 to 30 c.c. of carbolic water, 2 per cent., every fortnight under the skin of all pregnant cows from the fifth to the seventh month. (Many of the nostrums sold for use in bovine abortion are merely solutions of carbolic acid.) Bang considers this method of very uncertain value, the alleged good results being probably dependent upon the treatment of the genital organs, and the disinfection of the byres, practised at the same time. He adds, "The treatment is innocuous, and there is no need to dissuade any person from trying it who wishes to do so." Ostertag thinks the supposed benefit from this treatment may arise from the fact that contagious abortion sometimes stops of its own accord, and says that, if the carbolic treatment is ever effective, it certainly is not of benefit in the majority of cases. A similar procedure of Jarmoz[4] consists of inoculating under the skin 20 grams of a solution of mercury (1 in 1,000). Needless to say such measures, if practised at all, should be used in addition to, and not in substitution of, the vigorous treatment with disinfectants previously mentioned.

[1] Lysol, 1-100 and 1-200 parts of water, may be substituted respectively for the stronger and weaker solutions of mercuric chloride.

[2] Nocard and Leclainche, l.c., p. 410.

[3] *Deutsche Zeit für Tiermed,* XIV, 1888, p. 95.

[4] *Avortement epizootique des vaches.* Arch. de Med. Vet. (Russe), 1894, p. 284. Ref. Nocard and Leclainche, l.c., p. 410.

Vaccination Against Abortion.

Experience has shown that, even if untreated, cows acquire a certain tolerance of the microbe, evidenced at first by retardation of the epoch of abortion for each successive gestation, and ultimately by a natural calving. This circumstance is regarded as indicating that cows may become immune to the microbe, and the idea naturally led to attempts to produce this immunity by artificial means—that is, by inoculation or vaccination. Bang performed numerous experiments upon this point, the issue of which has been such as to lead him to believe that cows, sheep, and goats can be satisfactorily immunised. It appeared that successful immunisation required the use of living bacilli. Observations seem to indicate that the immunity in goats is of several years' duration.[1] Given the possession of suitable material, the preparation of such a vaccine could be investigated in this laboratory.

Legislation.

According to Bang, Norway is the only country where contagious abortion is a scheduled disease. By a Royal resolution of 22nd June, 1903, Infectious Abortion is scheduled under the so-called "*Minor Contagious Diseases*" (Law of 14th July, 1894, S14). The owner is obliged to report that such a disease is found in his herd. He is not allowed to bring animals with the disease to cattle shows, to foreign byres or fields, or to sell them otherwise than for slaughter. It is thought that this regulation, though not very satisfactory, is of some use in calling public attention to the disease. Bang thinks it should not be permissible to sell cows or bulls from an infected herd without indicating the existence of the disease, nor should such animals be admitted to common grazings.

Drying Process for Irish Blight.

Mr. D. McAlpine, Vegetable Pathologist to the Victorian Government, has been experimenting with the drying process for stamping out Irish Blight in potatoes (*Phytophthora infestans*), and a recent newspaper paragraph states that seed potatoes subjected to a temperature of between 120 and 130 degrees Fahr., planted on an area at Burnley Horticultural Gardens, grew equally as well as untreated potatoes alongside.

Jensen has for many years advocated the treatment of seeds by heat to destroy fungi. Mr. McAlpine's process requires exposure of the potatoes to the high temperature for four hours—a period which would no doubt present difficulties if the work were to be done on a commercial scale. Observations made in our Bureau of Microbiology, so far as they have gone, indicate that there may be some value in the method, but the work has not reached a conclusive stage. Some efforts made to treat potatoes on a large scale gave very irregular results. However, further observations are in progress.

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[1] Bang. Jl. Compar. Path. and Therapeutics, Vol. XXII, p. 264.

The Weeds of New South Wales.

KHAKI WEED (*Alternanthera Achryantha,* R.Br., var. *echinata; A. echinata,* Sm.).

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

Vernacular Name.—"Khaki Weed," because of the prevailing colour of the plant.

In the *Gazette* of September, 1909, p. 760, I have a note entitled "A so-called Australian Weed in South Africa." I referred to this weed as "*Alternanthera echinata,* Sm., a South African plant. It is united in the Index Kewensis, with *A. Achryantha,* R.Br.; but it differs a good deal from that species, and is at least a good variety."

In the *Agricultural Journal* of the Cape of Good Hope, December, 1909, p. 656, is the following note:—

> AMARANTUS WEED (*Alternanthera echinata,* Sm.).
>
> In the September issue of the New South Wales *Agricultural Gazette,* the noxious weed *Alternanthera echinata,* Sm., known in Cape Colony as the "Amarantus Weed," and in the Transvaal as "Khaki Weed," is credited as being a South African plant. This is not so. It was introduced during the war, probably in forage from the Argentine, the plant being of tropical American origin. This plant has been proclaimed under the Noxious Weed Act in the following districts:—Kimberley, Vryburg, Somerset East, Transkeian Territories, and Pondoland.

In the *Flora Capensis,* v. 432, under *A. Achryantha,* R.Br., we have *A. echinata,* Sm., as a synonym, with the note—"A native of Tropical South America, but now becoming a troublesome weed in Tropical and South Africa."

I believe it is correct to say that this weed was introduced to Australia from South Africa, although its original home is Tropical South America; and it is certainly a fact that in South Africa over large areas it was credited as being an Australian plant, and was thought to be so by many of our soldiers, who brought specimens back as a curiosity from South Africa. Perhaps it was introduced into Australia as a weed from South Africa; but I have not sufficient evidence on this point.

Botanical Name.—*Alternanthera,* from Latin *alterno* I change, or *alternus* alternate, and *anthera* an anther. The stamens (or anthers) alternate with the staminodia. *Achryantha,* from *achyrum* chaff, and *anthos* flower, in allusion to the chaffy nature of the flower.

Botanical Description

A prostrate herb, spreading over the ground in a thick mass; probably annual.

Stems.—Much branched, rooting at the nodes, woolly-hairy.

Leaves.—Shortly petiolate, from ovate-lanceolate to nearly orbicular, usually ½ to 1 inch long, light-green, glabrous or nearly so.

Flowers.—Bisexual, sessible, supported by scarious bracts in heads in the axils of the leaves and much shorter than the leaves, bracts and perianth-lobes all scarious and straw-coloured, narrow and acute.

Perianth.—Divided to the base into five irregular lobes, three outer ones (sepals) and two inner ones (petals). Two of the outer ones pungent, pointed, and longer than the third; the third less acute and denticulate in the upper part; the two inner ones equal, much shorter, gibbous, and with a prominent bunch of hairs on the back.

Stamens.—Five or fewer, united at the base into a short, exceedingly thin cup; very deciduous. Ovarium with a very short style and a single ovule.

Fruit.—A compressed indehiscent utricle.

Uses.—I know of none, except perhaps to assist in the recovery of humus on a scalded plain. So far as I know, stock never touch it. It is a humble plant.

We have an allied species, *Alternanthera triandra,* Lam., and the late Mr. P. Corbet, of Mount Browne, sent it to me with the information that the Chinamen of the district use this plant, to quote their own language, "to cure sore hands, sore anything." I believe its reputed virtues are imaginary.

Another closely related plant, though not belonging to the same genus, is *Achryanthes aspera,* L., which is found also in all the tropical and sub-tropical regions of the Old World, and also in several of the Australian States. The herb is administered in India in cases of dropsy. The seeds are given in hydrophobia and in cases of snake-bite, as well as in ophthalmia and cutaneous diseases. The flowering-spikes, rubbed with a little sugar, are made into pills, and given internally to people bitten by mad dogs. The leaves, taken fresh and reduced to a pulp, are considered a good remedy when applied externally to the bites of scorpions. The ashes of the plant yield a considerable quantity of potash, which is used in washing clothes. The flowering-spike has the reputation in India (Oude) of being a safe-guard against scorpions, which it is believed to paralyse (Drury). This is another plant which, in my view, has no medicinal value; at the same time no member of the family is poisonous.

Where found.—Already dealt with.

EXPLANATION OF PLATE.

1. Two clusters of flowers.
2. Part of a flower, the two outer perianth-lobes removed, showing the two inner perianth-lobes enclosing the fruit, and behind the short outer perianth-lobe.
3. A single flower, the bracts removed, showing the three irregular outer perianth-lobes and the two inner perianth-lobes.
4. Fruit, enclosing a single seed. Stamens and style have disappeared at the time of the fruit being nearly ripe.

KHAKI WEED.

ALTERNANTHERA ACHRYANTHA, R.BR. VARIETY ECHINATA.

Maize Huskers and Shellers.

As a commercial proposition, the cultivation of maize requires the adoption by the grower of the most modern appliances, within reasonable cost, for handling the crop. Several makes of huskers and shellers are now on the market, and one, the "Acme," is used at the Grafton Experiment Farm. The Department is not prepared to say that this is the best machine obtainable; but a photograph is given so that the attention of growers may be drawn to this new development in agricultural engineering.

Mr. A. H. Haywood, Manager of the Grafton Farm, has written the following report:—

Corn Husker and Sheller.

The "Acme" Improved No. 3, in use at the Grafton Experiment Farm.

The accompanying plate shows this machine as installed at this Farm, where it is worked by a 4-h.p. steam-engine. The manufacturers claim that it may be worked by horse-power; but it seems that where horse-power only is available a smaller size machine (No. 4, with capacity of about seven bags per hour) would be more suitable.

It takes not less than four attendants to man the "Acme" No. 3 machine, and the capacity as tested here turned out ten bags per hour (equal to 40 bushels).

The unhusked ears are conveyed to the hopper by means of an endless link belt with horizontal carriers attached. The mechanism of the machine adjusts itself to the different sized ears, which are husked and shelled, and the grain bagged, in the one operation.

Moving riddles and a fan-blower are the means by which the sample is cleaned.

The only grains carried off in the "tailings" are those adhering to the broken cores, which are few. In the whole of the operation less corn is lost than by an ordinary corn-sheller.

The success, however, of this machine depends entirely upon the condition of the corn, which must be perfectly dry for good work to be done. When the ears are damp or unripe the good and bad grains go together, but when perfectly dry the bad grains, being lighter, are blown out by the fans. Some varieties have cores which break up in the threshing (such as Large Red Hogan); others are less resistant to wet, having ears which are open or devoid of husk at the tips; others again are weak in the stalk, and the great majority bear the ears too far from the ground. These faults are conspicuous in a wet season, when the crop is more likely to lodge.

The defects mentioned may be overcome, to a great extent, when selecting the seed maize, which must be done in the field, choosing the varieties and individuals that do not possess these faults. On this Farm open cribs are specially built for the proper drying of the ears. These are constructed with battens nailed to 3 inch x 3 inch studs, placed 1½ inches apart on sides, bottom, and end, and raised 2 feet from the ground. The width should not exceed 10 feet and depth 8 feet. Stout wire-netting may be substituted for battens.

I consider that the machine which is installed here is suited to growers of maize having areas from 40 to 100 acres, and I can confidently recommend same, having found it efficient, and a great saving in time and labour.

Since the introduction of the machine to this Farm several improvements have been added to it which will be of value to users of this class of machine, and particulars of which will be available upon application to the Manager.

Trial with Husker and Thresher against old system of harvesting and treating maize.

One acre of maize was measured off for each test and the time kept. The results were as follow :—

Old method, to treat 1 acre of maize.

	£	s.	d.
5 men pulling, 2 hours each 10 hours at 9d.	0	7	6
1 ,, carting, 40 minutes	0	1	1
5 ,, husking by hand, 13½ hours	0	10	1
6 ,, threshing with Veteran shellers, 16 min. 1 hour 36 minutes	0	2	4
	£1	1	0

Husker and Thresher, to treat 1 acre of maize.

	£	s.	d.
5 men pulling, 2 hours each - 10 hours at 9d.	0	7	6
1 ,, carting, 40 minutes	0	1	1
6 ,, working machine, 1 hour each - 6 hours	0	4	6
	£0	13	1

Yield per acre, 50 bushels.

Capacity of husker and thresher in this test was 40 *bushels* per hour.

The saving by the use of the husker and thresher is 8s. *per acre*, or about 2*d. per bushel*, which may be taken as a fair average in all our work and justifies the introduction of this machine.

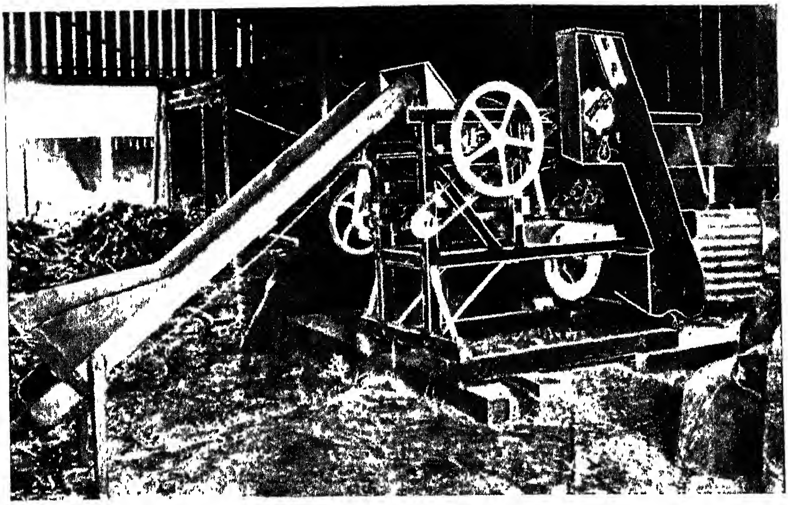
The following article by Mr. G. Marks, Inspector of Agriculture, deals with several other makes of machines now in use. The reader is left to his own judgment to select one of these or another make to suit his conditions :—

THE MAIZE HUSKER AND SHELLER.

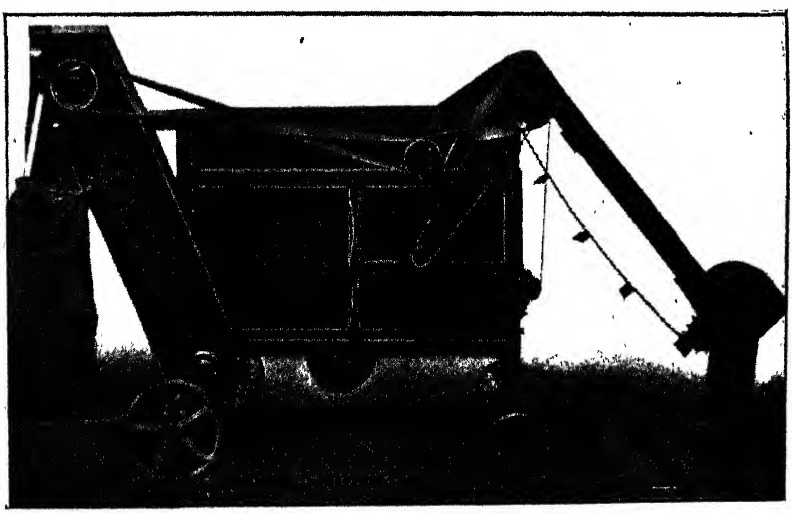
G. MARKS, Inspector of Agriculture.

FOR several years past a great deal of the maize grown in the Macleay district has been threshed by the maize husker and sheller, and latterly its use has been extended to the Hastings, Nambucca, and Bellinger districts. This machine has already been found a great boon to large maize-growers, and at the present time no less than three different makes may be seen working on farms along the North Coast, thus dispensing with the costly, slow, and tedious operations of husking and shelling by hand. In many places reliable labour is scarce, and consequently dear, so that there is not only a considerable saving in time, but the cost is also largely reduced. Although the mechanical arrangement of parts is slightly different in the various makes, the general principles are the same.

The large machine imported recently was at work in the Kinchela district on the Lower Macleay, and is owned by Messrs. Robinson Bros., Jerseyville, who procured it originally from Mr. Rickert, a Queensland inventor. It is driven by a Buffalo traction engine of 8 h.p., which is also utilised for drawing the machine from place to place. The working principles are briefly as follows :—The cobs in the husk are shovelled into a hopper at the base of a chain elevator, which conveys them to the drum. The drum consists of a steel cylinder, studded with steel pins. The concave is made also of steel in two sections, having parallel cross-bars on their

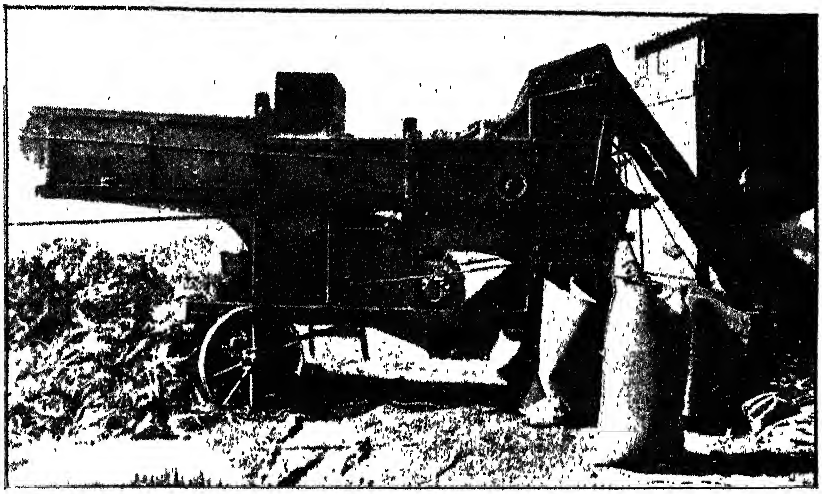


"Acme" Maize Husker and Sheller, in use at Grafton Experiment Farm.



"Excelsior" Maize Husker and Sheller, made by Mr. A. W. Scott, of Kempsey.

inner faces. One is placed at the back, and the other at the bottom of the cylinder. The bars give the rotary motion to the cobs as they are drawn in, while at the same time the husk is torn open and the grain shelled by the pins on the cylinder. By means of bolts and nuts the concaves may be adjusted to take any size of cob, and steel spiral springs overcome any irregularity of pressure caused by large and small cobs going through at the same time. The whole mass, after passing through, is thrown on to a set of rotary shakers, where the grain falls through on to a lip-sieve, and the cores with their husks attached, are carried away from the machine. The grain slides down the lip-sieve on to a perforated screen, and in doing so is subjected to a strong blast, regulated and worked by a fan. Any dust, dry mouldy grain, or other light refuse is carried away, leaving clean bright



Maize Husker and Sheller (owned by Messrs. Robinson Bros., Jerseyville).

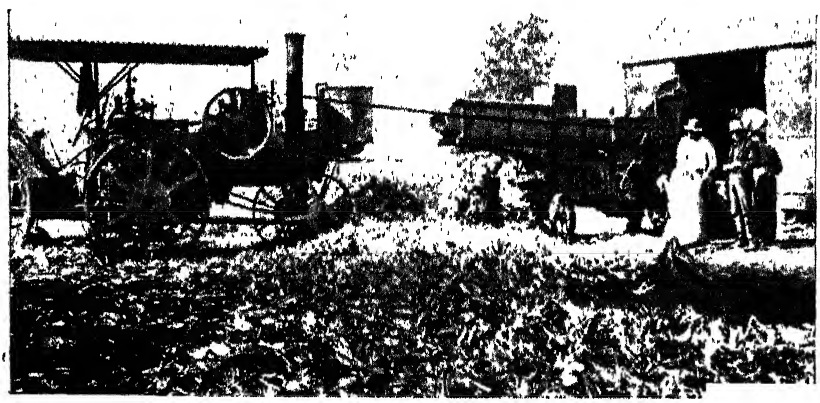
grain to slide down another lip-sieve into a receiver, where a bucket elevator conveys it to a duplex bagger. At the bottom of the receiver is another perforated screen, where any broken grain that may pass along is separated.

This husker and sheller is 19 feet long, 7 feet high, and 2 feet 6 inches across. It has a capacity of 160 to 200 bushels per hour, according to the condition of the maize. The owner provides four men and pays for their keep, while the farmer provides the necessary men to sew and stack the bags. Two men are required to feed the elevator, one to work the bagger, one to drive and keep the machine free of refuse, husks, &c. The cores and husks are used as fuel, and the farmer is charged 7d. per 4-bushel bag.

From inquiries made in the district, the cost of husking and threshing by hand is 25s. per 100 bushels, or 1s. per 4-bushel bag. Husking may be set down at from 14s. to 16s. per 100 bushels, and threshing at 4d. per 4-bushel bag. Threshing by horse-gear costs about 3d. per 4-bushel bag.

With one horse and five men, from 120 to 150 bags would be threshed in a working day of 10 hours. By hand three men would thresh in 10 hours about 50 bags. With the power husker and sheller, and eight men, from 400 to 500 bags would be threshed in 10 hours. It will thus be seen what a saving is effected in both labour and time, besides dispensing with the hand husking.

For the average maize-grower a much smaller machine is desirable. Mr. A. W. Scott, of Kempsey, is making combined huskers and shellers in three sizes, viz.—30, 50, and from 80 to 100 bags per hour, requiring from 2-h.p. to 6-h.p. engines to work them. The general working principles are similar to the one just described. A smaller power machine, having a capacity of 16 bags per hour, and requiring three men, was seen working on Mr. J. Hibbard's farm on the Maria River.



Messrs. Robinson Bros.' Maize Husker and Sheller at work.

For efficient work, it is essential to have any of the machines set perfectly level. If tilted at either end, it is found that the grain will not be properly cleaned—either by the blast not being able to separate the inferior light grain; or, inclined in the opposite direction, by the blast carrying away a quantity of the sound grain. Provided that the cobs are perfectly dry, and the cores sound, any inferior mouldy grain is easily separated. The reason of this is that while on the screens, the light inferior grains rise to the top, and with a properly regulated blast are readily separated in falling over the edges of the lip-sieves.

The drier and sounder the cobs, the better the machine will work. It is not advisable to use the machine to thresh any cobs having damp soft cores, or maize that has just been harvested.

It is necessary to see that the concaves are properly adjusted so as to ensure clean threshing. This is particularly necessary when changing from a large to a small variety.

Orchard Notes.

W. J. ALLEN.

NOVEMBER.

Late Frosts.

ON Monday and Tuesday, the 10th and 11th of October, cold winds blew without ceasing, and in many places the thermometer registered from 1 to 3 degrees of frost. This was not at all conducive to the setting of fruit, and in many of the higher levels the trees received a check; but on the night of the 11th, there was a particularly heavy frost of 12 degrees, and the fruit crops between Werris Creek and Glen Innes were wiped out—most of the growers losing everything. This loss will fall heavily on a good many, particularly as the prospects for a bumper crop had never been brighter. At the Glen Innes Experiment Orchard the crop was completely destroyed, which means at the least a loss of £400 to us. There is some satisfaction, though, in knowing that all the higher levels in the State have not suffered in a like manner.

Cultivation.

The most important work for this time of the year is cultivation. If neglected at this particular season there is very little hope of harvesting crops of fruit which will be payable. Cultivation is the one work which cannot be neglected and without which no grower can hope to succeed. I would, therefore, urge on all our growers the necessity of keeping their land well worked up to a good depth, and under no consideration leave the ploughing too late in the spring, as during most seasons we require all the moisture which we can possibly conserve, in order to keep the tree in a healthy and growing condition, so that in its turn it may be able to supply the fruit with the required nourishment to bring it to maturity; therefore, work the land well in the early spring, and from that time see that it is kept loose by constant cultivation.

Summer Pruning.

Summer pruning may be started this month, and it is well to go over and regulate the growth of all young trees, thinning and shortening back where required—that is, where the tree is growing too thick—and pruning or pinching back, so as to keep the tree evenly balanced and symmetrical. This early summer pruning is more for young trees, to aid in directing the growth to that part of the tree where it is most required.

Codling Moth.

The orchard should be kept free of any rubbish which will harbour the Codling Moth, and the bandages placed around the stem of the tree to catch the grubs of same should be removed every seven to eight days, and all grubs killed. It is most important that all fallen fruit should be picked up and destroyed regularly. Continue spraying with arsenate of lead for Codling Moth.

Thinning Fruit.

Thin apricots and peaches where they have set too thickly.

Harvesting.

The harvesting of the orange and lemon crop will be about completed this month. Early apricots, peaches, and cherries will commence. See that all are well graded, and put up in the most attractive manner. Neither apricots nor peaches should be allowed to become over-ripe before being marketed. As a matter of fact, they should be picked on the green side, as it is usually a few days before they reach the consumer, after they leave the orchard, by which time they are in about right condition for use.

Currant Drying Rack.

The trestles are 8 feet apart, made of stout timber, and wire-netting stretched, of 1½ or 2-inch mesh, 17 gauge, and 3 feet 6 inches wide. The netting is supported by three strands of No. 8 wire tightly strained, one on each of outer edges, and one in the centre. The racks are about 1 foot apart, and top rack may be covered with hessian to protect from sun and weather. Some use double width; but the single width is preferred.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th (imp.).	Wollongbar Farm	†
,, ...	March Pansy ...	Earl March ...	Australian Pansy.	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II. ...	Thessalian (imp.).	Egyptian Princess (imp.).	Wagga Exp. Farm	*
,, ...	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm ...	*
Guernsey ..	Gentle Prince ...	Rose Prince (imp.).	Gentle ...	Wyrallah	7 Mar., '11.
,, ..	The King's Mirror.	Calm Prince ...	Vivid (imp.)...	Lismore	10 April, '11.
,, ..	Star Prince ...	Calm Prince ...	Vivid (imp.)...	Dunoon	3 April, '11.
,, ..	Prince Souvia ...	Vivid's Prince...	Souvenir(imp.)	South Woodburn..	21 Dec., '10.
,, ...	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Wollongbar Farm	*
,, ...	Claudius ...	Golden Star II..	Claudia's Pride (imp.).	H.A.College, Richmond	*
,, ...	King of the Roses	Hayes' King ...	Rose 8th (imp.)	Berry Farm ...	*
,, ..	Royal Preel ...	Otchen Royal ...	Hayes' Lily du Preel (imp.).	Cumbalum ...	10 Jan., '11.
Red Poll .	The Judge ...	Barrister (imp.)	Lovely 8th (imp.).	Grafton Farm ...	*
Ayrshire ..	Don Juan ...	General (imp.)...	Judy 9th (imp.)	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ..	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ..	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Dan of the Roses	Daniel of Auchenbrain (imp.).	Ripple Rose...	H.A.College, Richmond	*
Kerry... ..	Kildare II ...	Kildare (imp.)...	Belvedere Bratha 3rd (imp.).	,, ,,	*
,, ...	Bratha's Boy ...	Aicme Chin (imp.).	Bratha 4th ...	,, ,,	*
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*
Holstein ...	Hollander ...	Bosch III. (imp.)	Margaretha (imp.).	Berry Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

Department of Agriculture,
Sydney, 2nd November, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

AYRSHIRES.—Romeo: sire, Auchenbrain Spicy Jock (imp.); dam, Juliette; calved 12th May, 1909; colour, dark brown and white. Price, **£25.**
Juliette is from Judy 9th of Barcheskie (imp.), by Mischiefmaker (imp.).

Sandy: sire, Auchenbrain Spicy Jock (imp.); dam, Rose Flower; calved 8th April, 1909; colour, brown and white. Price, **£20.**
Rose Flower is from Roseberry, by Daniel of Auchenbrain (imp.). Roseberry from Roseleaf of Barcheskie (imp.), by Mischiefmaker (imp.).

GUERNSEY.—Halley's Comet: sire, Star Prince; dam, Flaxy II; calved 1st September, 1909; colour, lemon and white. Price, **£45.**
Flaxy II is from Flaxy (imp.), by Rose Prince (imp.). Star Prince from Vivid (imp.), by Calm Prince.
Halley's Comet has a double cross of Rose Prince blood.

HOLSTEIN.—Keizer: sire, Hollander; dam, Maggie Obbe; calved 22nd October, 1909; colour, brown and white. Price, **£10.**

HAWKESBURY AGRICULTURAL COLLEGE.

AYRSHIRES.—Dado: sire, Daniel of Auchenbrain (imp.); dam, Dot, by Hover of Southwick (imp.), from Flirt, by Heir of Randwick (imp.), from Lady of Randwick; calved 23rd March, 1904; colour, white and brown. Price, **£15.**

Emerald's Mischief: sire, Prince Emerald (imp.): dam, Miss Prim, by Mischiefmaker of Barcheskie (imp.), from Primrose of Barcheskie (imp.), by Royal Stuart of Glenbuck, from Lindsay 7th of Barcheskie; calved 4th August, 1903; colour, white and red. Price, **£25.**

WOLLONGBAR EXPERIMENT FARM.

HOLSTEIN.—De Wet: No. 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909. Price, **£10.**

AYRSHIRES.—Colonel: No. 211. Sire, Jamie's Ayr; dam, Colon; calved 26th December, 1909; colour, red and white. Price, **£15.**

The Pretender: No. 200. Sire, Jamie's Ayr; dam, Juda; calved 25th October, 1909; colour, white and red. Price, **£15.**

GUERNSEY.—Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909. Price, **£45.**

H. C. L. ANDERSON,
Under Secretary.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1910.

Society.	Secretary.	Date.
Mullumbimby A. Society	N. Neilsen	Nov. 9, 10
Tweed River A. Society (Murwillumbah)	A. E. Budd	„ 16, 17
Newcastle A., H., and I. Association (Spring Show)	C. W. Donnelly	„ 18, 19
Lismore A. and I. Society (State National Show)	T. M. Hewitt	„ 22–25

1911.

Albion Park A. and H. Association	H. G. Fraser	Jan. 18, 19
Kiama A. Association	R. Somerville	„ 25, 26
Alstonville A. Society	W. W. Monaghan	Feb. 8, 9
Berry A. Association	C. W. Osborne	„ 8, 9
Moruya A. and P. Society	P. Flynn	„ 8, 9
Coramba District P., A., and H. Society	H. E. Hindmarsh	„ 15, 16
Shoalhaven A. and H. Association (Nowra)	H. Rauch	„ 15, 16
Gunning P., A., and I. Society	J. L. Sands	„ 22, 23
Manning River A. and H. Association (Taree)	S. Whitbread	„ 22, 23
Kangaroo Valley A. and H. Association	J. Moffit	„ 23, 24
Nambucca A. and H. Association	E. M. Walker	„ 23, 24
Wyong A. Association	J. H. Kay	„ 23, 24, 25
Southern New England P. and A. Association (Uralla)	W. C. McCrossin	„ 28, Mar. 1, 2
Inverell P. and A. Association	J. McIlveen	„ 28, Mar. 1, 2, 3
Braidwood P., A., and H. Association	L. Chapman	Mar. 1, 2
Robertson A. and H. Society	R. J. Ferguson	„ 2, 3
Bowraville A. Association	C. Moseley	„ 2, 3
Gundagai P. and A. Society	A. Elworthy	„ 7, 8
Bangalow A. and I. Society	W. H. Reading	„ 7, 8, 9
Tenterfield P., A., and M. Society	F. W. Hoskin	„ 7–11
Bombala Exhibition Society	W. G. Tweedie	„ 8, 9
Tumbarumba and Upper Murray P. and A. Society	E. W. Figures	„ 8, 9
Macleay A., H., and I. Association (Kempsey)	E. Weeks	„ 8, 9, 10
Crookwell A., P., and H. Society (Annual Show)	M. P. Levy	„ 9, 10
Nepean District A., H., and I. Society (Penrith)	P. C. Smith	„ 9, 10
Berrima District A., H., and I. Society (Moss Vale)	I. Cullen	„ 9, 10, 11
Central New England P. and A. Association (Glen Innes)	G. A. Priest	„ 14, 15, 16
Campbelltown A. Association	F. Sheather	„ 15, 16
Cobargo A., P., and H. Society	T. Kennelly	„ 15, 16
Tumut A. and P. Association	T. E. Wilkinson	„ 15, 16
Bellinger River A. Association (Bellingen)	S. S. Hindmarsh	„ 15, 16, 17
Mudgee A. Society	H. Lamerton	„ 15, 16, 17
Port Macquarie and Hastings District A. and H. Society	W. R. Stacy	„ 16, 17

Society.	Secretary.	Date.
Goulburn A., P., and H. Society	J. J. Roberts ...	Mar. 16, 17, 18
Armidale and New England P., A., and H. Association	A. McArthur ..	,, 21 24
Camden A., H., and I. Society...	C. A. Thompson...	,, 22, 23, 24
Clarence P. and A. Society (Grafton)	T. T. Bawden ...	,, 22, 23, 24
Taralga A., P., and H. Association	G. C. Goodhew ..	,, 23, 24
Newcastle A., H., and I. Association (Annual Show)	C. W. Donnelly...	,, 23, 24, 25
Blayney A. and P. Association	E. J. Dann ...	,, 28, 29
Lower Clarence A. Society (Maclean)...	F. W. Collison ...	,, 28, 29
Luddenham A. and H. Society...	E. Shawe... ...	,, 28, 29
Walcha P. and A. Association	J. New-Campbell	,, 28, 29
Yass P. and A. Association	W. Thomson ...	,, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 5, 6
Dorrigo A. Society	F. T. Stennett ..	,, 5, 6
Dungog A. and H. Association	C. E. Grant ...	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 5, 6, 7
Royal A. Society of N.S.W. (Sydney)...	H. M. Somer ...	,, 11-19
Queanbeyan P., A., H., and I. Association	E. C. Hinchsman	,, 12, 13
Bathurst A., H., and P. Association	A. H. Newsham ..	,, 26, 27, 28
Richmond River A. P. and H. Society (Casino) ...	D. S. Rayner ..	May 3, 4
Orange A. and P. Association	W. Tanner ...	,, 3, 4, 5
Hay P. and A. Association	G. S. Camden ...	July 11, 12
National A. and I. Association, Brisbane, Queensland	C. A. Arvier ...	Aug. 7-12
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	,, 22, 23, 24
Young P. and A. Association	G. S. Whiteman...	Sept. 5, 6, 7
Germanton P. and A. Society	J. S. Stewart ...	,, 6, 7
Junee P., A., and I. Association	T. C. Humphrys...	,, 6, 7

Contributions to the Farrer Memorial Fund.

Name.	Address.	£	s.	d.
Amount received to 21st September, 1910		942	17	10
W. W. Killen	Sydney	2	2	0
Samuel Hordern	do	5	5	0
F. and S. Association	Millthorpe	1	7	6
Do do	East Tenterfield	0	10	6
Do do	Wagga	2	2	0
F. Strout	do	0	10	0
J. Halloran	do	0	10	0
A. Mackay	do	0	10	0
G. Lindon	do	0	10	0
F. and S. Association	Lockwood and Cranbury ...	7	0	6
A. and P. Association	Tumut	1	1	0
Total amount received to 21st October, 1910		£964	6	4

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Agricultural Gazette of New South Wales.

Sheep and Wool for the Farmers.

THE QUESTION OF WOOL—SYSTEM OF MATING.

J. WRENFORD MATHEWS.

A FULL description of the wool of these different breeds could not reasonably be undertaken at this stage. Still we must anticipate somewhat in order to be in a position to compare the relative merits of different strains.

The quality of wool is generally expressed by what are technically known as "Counts." Wool is valued on its quality, so that these counts furnish a basis for fixing the value of wool. The counts are calculated on a mathematical basis; and, indeed, in no other way could the value of the wool be accurately determined. Where cross-bred wools are concerned, these counts vary from 36's, which is the average quality of a pure Lincoln wool, to 60's, which represent the quality of a coarse grade of Merino. "Counts" being a proportional expression of fineness, it follows that many higher standard counts, say 64's, 70's, 76's, and 80's, are not uncommon among the finer Merino wools. Sometimes counts ranging to 90's, and even as high as 100's, are employed, but since these are seldom if ever applied in the Australian markets, they are of much less interest from our point of view. For all practical purposes it will be sufficient to note that the higher the count the finer is the wool; that is, the thinner is the fibre, both in absolute diameter and in proportion to the length of staple. There are, however, some counts of Merino which prove exceptions to this rule. The magnificent superfine Merino wools grown, for example, in the Western Districts of Victoria, have, in combination with their beautiful fineness, an increased length of staple as compared with the average wools of the same quality grown in other districts. Between the Lincoln and the Merino there have been established seven different qualities or standard market "counts"; so that a Lincoln-Merino cross-bred sheep might produce wool of any one of these various "counts," according to which of the original strains predominated in the sheep. In the first cross Lincoln on Merino, the quality would be intermediate between Lincoln quality, say 36's, and Merino quality, 60's, provided that that particular Merino strain was employed. This means that it would vary from 46's to 50's, or would be coarser or finer according as the cross bred "threw" towards the Lincoln or Merino. A finer Merino than one carrying a 60's fleece would give a still wider range of quality.

The accompanying diagram will probably make these facts quite clear. The numbers on the left hand margin of the diagram denote the length in inches of the staple in different qualities or counts. They give average lengths in

each case. The average length of a pure Lincoln wool is stated as 12 inches, and that of a pure Merino as $3\frac{1}{2}$ inches; but in each case the length given may be considerably exceeded.

It will be noted that the intervals between counts vary considerably. The counts given are those for the standards usually set by the manufacturers, and recognised by their representatives. The diagram indicates these differences graphically. The area above the oblique dotted line represents length of staple; the area below this line indicates density. It will therefore be readily seen that density is inversely proportional to length, which is only another way of saying, the greater the length the less the density, and *vice versâ*. Along the bottom of the diagram is shown the relative proportions of each in the cross. The extreme right represents pure-bred Merino, the extreme left a pure Lincoln. Then, for example, we have a sheep, $\frac{6}{8}$ Lincoln and $\frac{2}{8}$ Merino, yielding a wool of 44's quality.

System of Mating.

Since crossing must be carried on for an indefinite period, it is necessary to work on a definite system, and to have a clear understanding of the objects aimed at. Some Long-wool breed, the Lincoln for choice, must be so crossed with the Merino, as to produce a progeny characterised by what have been already sufficiently described as the most desirable qualities in a cross-bred sheep.

The ideal cross-bred would be a sheep possessing great body weight combined with a very valuable fleece; but this combination is, as already stated, very hard to obtain. Only by a sound and definite system of mating can the distinct characteristics of each breed be successfully and uniformily blended into a serviceable sheep. The importance of length of staple as a factor in the production of a profitable fleece has been already referred to. Scarcely less important is density, in adding to the weight and consequent value of the fleece. Nor can body development, since it means increased value of the carcase, be lost sight of in a cross-bred sheep. Moreover, from a purely wool-producing standpoint, size of body should be proportioned to length and consequent coarseness of fleece. As the quality decreases, so must the quantity increase. For example, a small-framed sheep cannot possibly produce enough of a coarser and lower priced wool to make itself as profitable as a sheep with either a larger frame or a finer wool. Thus if the cross-bred resembles the Long-wool more than the Merino in quality of fleece, then the size of the body should be proportionately large; otherwise no advantage would be gained by breeding such types.

How, then, are the breeds at our disposal to be so mated as to enable the progeny to combine a larger body, an increased length of staple and full density of fleece? This depends almost entirely upon the correctness and completeness of the system of mating. The Long-wool's larger body and greater length of staple must, by judicious crossing, be uniformly blended with the smaller frame, fine quality and consequent greater density of the Merino.

First Cross.

Long-wools, particularly the Lincoln, when mated with the Merino, do not give a particularly uniform class of cross-bred. This sheep, however, generally known as the "first cross," is certainly the strain most commonly found in cross-bred flocks. It is very desirable that this lack of uniformity should be eliminated, in the interests not only of the immediate crosses, but also of the future crosses and types evolved from them.

The laws of heredity are still but imperfectly understood, and it is difficult to explain how the union of sheep of two distinct but definite breeds gives cross-breds possessing such varied characteristics. But still man holds the power of selection, and it seems possible that in the search for the ideal cross-bred sheep, he may so employ that power as to intensify the type in either direction, and thus obviate in a great measure such lack of uniformity.

The common practice has been to place the Merino ram on to the first cross, and thus produce the finer-woolled fine cross-bred, or what is better known as the "comeback" sheep. This would, no doubt, be the quicker and perhaps the more convenient way of working into the finer-quality sheep. The gain in quality is obvious enough, but it is at the expense of length of staple, and, in a much more marked degree, size of frame; and it is length of staple and size of frame that make the Long-wool valuable when mated with the Merino to yield a first cross, or, in fact, any sheep of the cross-bred strains.

Second Cross.

The further development of the cross-bred should be effected by placing a Long-wool breed on the first cross. The immediate effect of this combination on the wool would be to greatly increase its coarseness. Expressing the fineness by "counts," as before, it may be stated that while the wool of a "first cross," such as we have described, would average from "46's" to "50's," or be even finer, the wool of the second cross, should the Lincoln be used, would range from 40's to 44's. This does not, however, necessarily mean a decrease in the value of the fleece, nor of the sheep. The extra length of staple and consequently greater yield of wool, not to mention the greater size of frame, would much more than compensate for what may be lost in quality. This second cross, with two Long-wool strains to one of Merino, is in itself a valuable sheep, carrying wool of great length and of good lustre. Moreover, by thus intensifying the type, in this case towards the Long-wool side, we get in this second cross, in addition to size of frame and length of fleece, a type of sheep that is much more uniform than the first cross.

Third Cross.

Though this second cross is by no means the ideal cross-bred sheep, still it forms an excellent foundation for subsequent development of the fine cross-bred. Having thus obtained size of frame in combination with length and weight of fleece in the second cross, such a breed as will give greater density and higher quality to the subsequent crosses must be sought. The Merino

has been described as possessing these desired qualities. It is, therefore, on the second cross that the Merino ram should be used.

It should scarcely be necessary to repeat that the employment of the right strain of Merino is of the greatest importance. Any breeder knows that the introduction of the Merino into any breed or cross-breed has the effect of thickening and tightening up the fleece. But even between one Merino and another there are marked differences in fleece, frame, and constitution. The most useful Merino strains have not always been used for the purpose for which they were by nature more specially fitted. Small-framed, fine quality, dense-woolled Merino rams have frequently been employed for mating with cross-breds, just as Merino ewes of a similar type have been mated with Long-wool rams in the mistaken endeavour to produce a cross-bred of good wool type, as in the case of the first cross. Seeing that body development and length of staple are the points primarily aimed at, it is necessary that the largest framed and longest stapled of robust-woolled Merino rams should be chosen.

A ram of this type should be placed on the second cross. As a result of this union, the most valuable cross-bred wool type is evolved. This sheep, known as the fine cross-bred, we shall term the "third cross." This third cross carries a fleece of greatly improved quality, and ranging from 50's to 56's in "count." Both the quality and greater density of the Merino, and the Long-wool's greater length of staple and greater size of body, have, by such systematic mating, been transmitted to this cross. Moreover, this third cross exhibits, both in length and quality of fleece, a much greater degree of uniformity.

Fourth Cross or Comeback Types.

But this system may be extended still further with satisfactory results. Many breeders aim at producing an even finer quality cross-bred sheep. With this object, the Merino ram may again be used on the "third cross" or fine cross-bred class. The outcome of this combination is the "fourth" or "super" cross; or what is more familiarly known as the "comeback."

The comparatively fine quality of the wool of this animal makes the sheep a most important and valuable contribution to Australian cross-bred types. The wool is subject to but slight variation in quality, owing to the combined influence of the Merino and of the fine quality of the preceding third cross. Technically it varies from the 56's to the 60's qualities, the market standard being the 58's count.

It should be noted here that a 60's cross-bred wool is not quite the same as a 60's count in pure Merino wool. The Merino is rather more valuable on a quality base. The Merino wool would certainly be the more valuable as estimated on a basis of the yield of clean scoured wool, being worth a little more in the pure state. Yet the cross-bred of 60's quality would yield in clean wool a higher percentage of its weight in the greasy state. Consequently it frequently sells at a higher price per pound than pure Merino wool of the same count. This may appear strange till it is remembered that the Americans are very large buyers of our cross-bred wools. Australian wool

pays a high duty on going into the United States, and American buyers, in view of the larger "scoured" yield, have come to operate largely on our medium, fine, and super. quality cross-bred wools.

Subsequent Crosses.

Always provided that a definite object be kept in view, this system of crossing need not necessarily stop here. We have now arrived at what we may term our "fourth cross," and so far as quality is concerned, we have worked back to an almost pure Merino strain. In view of the importance of body development, it would not be wise to use the Merino ram in the next cross. The system thus resolves itself into the alternate use of the two original breeds, and we have so far described the method known as "line breeding." So the Long-wool ram, be it Lincoln or otherwise, should be placed on to the "comeback" or "fourth cross." After this the Merino ram may be again used, and so this system of breeding be successfully carried on for all time.

The Use of Grades.

Every breeder must remember that whilst grade or cross-bred ewes may be used, experience has proved that the use of pure-bred rams of both breeds is an essential condition of success. It is very necessary that rams of good quality and fair average type should be employed. It will always pay to spend a little extra money on the ram, for such small outlay will be more than compensated for by the additional value of the progeny. A good ewe will affect the type only of her own offspring, whereas the excellence of the ram may be transmitted throughout the whole flock. Then again the breeder should never overlook the fact that, to secure the best results in cross-breeding, a frequent change of blood is necessary to prevent inbreeding and consequent degeneration. Many attempts have been made by breeders situated in localities favourable to such cross-bred types to establish a fixed wool type, intermediate between the two great wool types; but these attempts have not, so far, been attended with any very marked success. A fairly uniform type has certainly been produced, but the great difficulty is in getting such animals to reproduce their own equals—that is, to perpetuate the type. Shapely enough animals have been raised in the first, and even the second, generations, by the use of grades; but sooner or later the principle of reversion to type asserts itself, accompanied by a distinct falling off in fleece production. Thus the weight of evidence at present is vastly in favour of the use of pure-bred sires of the old original breeds. The use of grade sires, whose "get" is at all times uncertain, must prove unsatisfactory, and cannot be too strongly condemned. In his choice of strains, it will always pay the farmer to select his breeding-stock from the flocks of those reputable breeders who have maintained absolute purity of type.

Management of the Crosses.

To the man who has not had much experience in the breeding of cross-bred sheep, this system may appear somewhat cumbersome. He may, for instance, find that he is caused some trouble and inconvenience by the

necessity for keeping each cross separate. This may be effected either by an efficient system of earmarking, or by keeping the sheep in separate paddocks, or both. Earmarking is essential under all circumstances The use of separate paddocks is of less importance, since it is only at mating time that the ewes require to be separated into their respective groups, according to the system as set forth.

The ewe lambs will in each case be retained for the breeding of the succeeding cross, but the wethers of each generation can be successfully carried over, and disposed of at such times as they yield the maximum profit. This depends on local conditions, on feeding, and on the Long-wool breeds employed. We have consistently classified the different Long-wool breeds according to their increasing early maturity and decreasing fleece production. Even amongst Long-wool strains, certain breeds are conspicuous for their earlier maturity, and for all those reasons already stated at some length, it will pay to dispose of wether lambs of such breeds in their earlier stages. In the case of the later maturers, it is better to hold this stock until their slower development has produced a profitable combination of fleece and carcase.

But the farmer must always, particularly if breeding a wool type, guard against the practice of disposing of the ewe lambs. The immediate profit obtainable in this way is at the expense of giving away the nucleus of his flock. This is of equal importance with the use of pure sires. Indeed the main principles for the successful breeder are the use of pure sires, the retention of the ewe lambs, systematic culling, and a proper system of feeding.

Available Long-wools.

The Long-wool types available for crossing with the Merino for the production of cross-bred wool sheep are Lincoln, Cotswold, Leicester, Border Leicester, Romney Marsh, and Cheviot. Of these the Cotswold closely resembles the Lincoln as a wool producer, and under most Australian conditions the Lincoln can profitable replace it, while the Leicester, under similar circumstances, is a superior mutton sheep. The Romney Marsh, though a highly valuable sheep in a humid climate and on swampy soils, does not show to the same advantage in the districts where cross-bred sheep are kept. The Cheviot, another hardy breed, with a lighter fleece, would be more profitable in its pure state and in those localities more suitable to it. Of the Long-wool breeds, therefore, only the Lincoln, Leicester, and Border Leicester call for any extended discussion.

Lincoln-Merino Cross.

Amongst present-day cross-breeders this combination is easily the most popular. Quite recently the *Australasian* newspaper invited the most prominent Victorian growers to express their views with respect to the best class of sheep for farmers' flocks. Two-thirds of the contributors declared themselves in favour of the Lincoln-Merino cross, for both wool and carcase. And rightly, too, because for length and weight of fleece, character of staple,

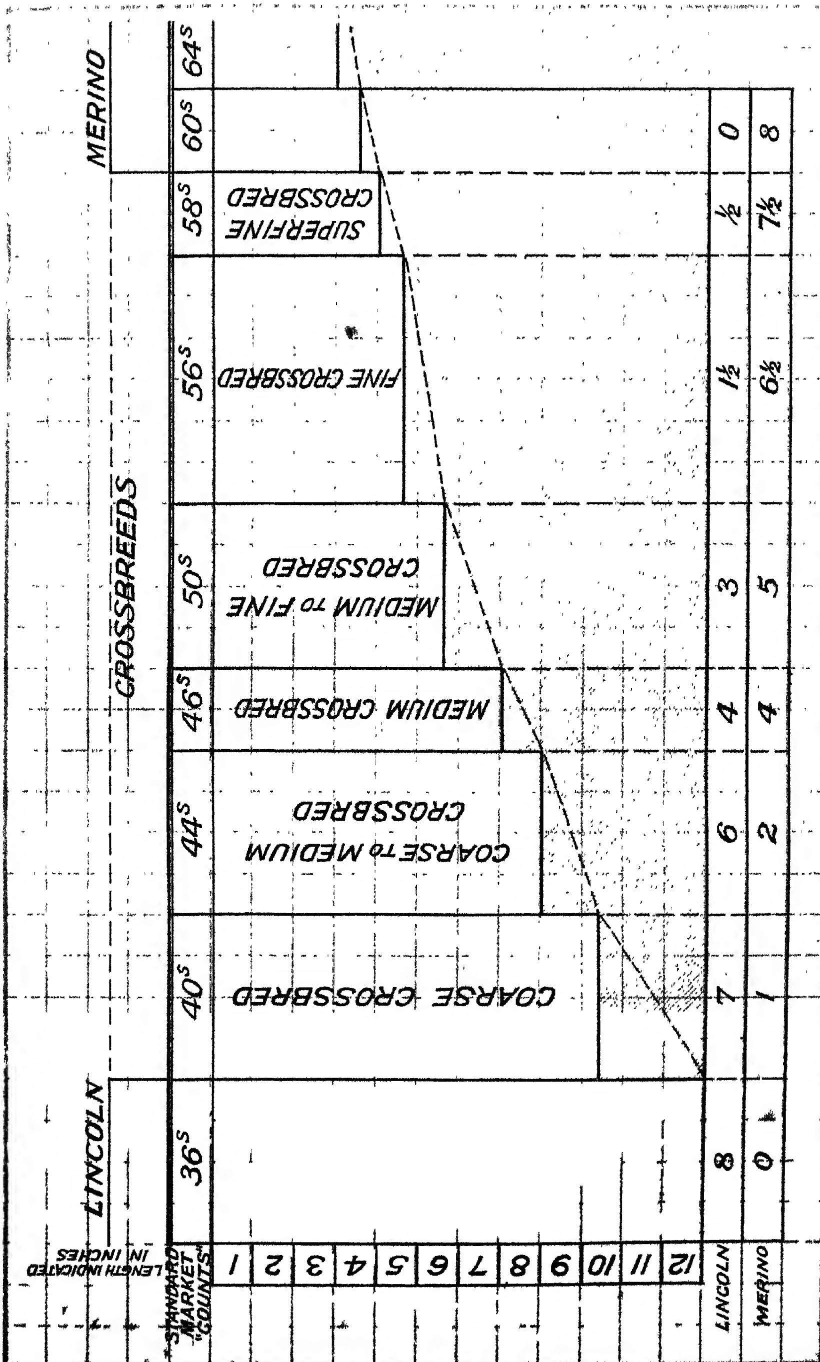


Diagram I, showing comparative length of staple proportionate to quality in wool of cross-breeds between Lincoln and Merino.

good spinning fibre and lustre, the Lincoln on the big-framed Merino easily outrivals all other breeds, and it is a good mutton sheep as well.

Strangely enough, there is no other breed with which the Merino blends more readily than the Lincoln. This is fully proved by the most reliable experimental evidence, and even thus early one may safely predict that the Lincoln-Merino will in the future become the most common of all cross-bred types. The Lincoln and Merino are quite distinct in type, and entirely opposed in fleece, frame, and constitution. The Merino is a Short-wool, and thrives in a hot climate; the Lincoln is a Long-wool, and is at home in the cold. Yet there appears to be some unique and inexplicable affinity between them. It is remarkable to note how the coarser nature of the Lincoln harmonises with the finer qualities and more refined nature of the Merino, to form a type highly profitable and most suitable to the majority of our agricultural areas.

The Lincoln and the Merino are comparatively slow maturers, and this later maturity is also very characteristic of cross-bred strains produced as a result of their union. Associated with this slower maturity is a more perfect development of the form and symmetry of this cross-bred, as compared with the more prominent characteristics of the parent strains. Whether there is any causal connection between these conditions is a matter awaiting further investigation. Yet the chief value of the Lincoln-Merino cross lies not so much in its body development as in its ability to produce a profitable fleece during the later years of its life. A Lincoln-Merino wether is thus always a profitable sheep to hold, because, while maturing, he will yield from year to year a very profitable fleece and develop meanwhile a most profitable carcase. The underlying principle of earlier maturity as related to fleece-production we cannot afford to disregard when selecting suitable Long-wool breeds for mating for the production of wool.

For other reasons, again, the Lincoln-Merino cross ranks as a most useful type of sheep. The ewe is a splendid mother. Under average circumstances, and given anything like a fair supply of suitable feed, she will always give a good supply of milk. More important still is the suitability of this cross for mating with other breeds. With the early-maturing Down or Short-wool breeds, it forms a foundation from which a most profitable early marketable mutton type may be evolved. The experience of breeders has already clearly demonstrated its value for this purpose.

Leicester-Merino Cross.

The Lincoln has had full credit for its long descent, and for the weight and length of staple of its fleece. Still it must be kept in mind that the Lincoln is a coarse-woolled sheep, and we cannot afford, in the effort to evolve commercial cross-breds, to entirely disregard quality. Not only is the Lincoln coarse-woolled; its flesh is coarse also.

The Leicester is a somewhat finer-natured sheep. Its wool is of higher quality, and its flesh, in fineness of grain and sweetness of flavour, is markedly superior to that of the Lincoln. We must aim at quality in flesh as well as

in wool. Those breeders who have raised mutton types have generally paid due attention to this matter. So forcibly has this principle impressed itself on their minds, that they are always prepared to sacrifice bulk, in order to secure a little better quality. In quality of fleece, as reference to the diagram will show at a glance, the Leicester has the advantage of the Lincoln. It is also, as we have said, an earlier maturer. In choosing between those sheep, the farmer must weigh the merits of the heavier but coarser Lincoln against the finer wool and mutton of the earlier-maturing Leicester, and decide whether these latter qualities, together with the improved quality of the fleece, will compensate for what, in rejecting the Lincoln, he is losing in bulk and length of staple. The extent to which early maturity will modify fleece production is a matter not yet definitely settled, nor has the exact relationship of increasing quality to decreasing quantity been, so far, accurately determined.

Border Leicester-Lincoln-Merino, 4-tooth.

The Leicester is a much more evenly proportioned sheep than the Lincoln. It is noted for the squareness and symmetry of its frame. It is also finer boned, and this makes it superior to the Lincoln as a mutton sheep. The Leicester, when mated with the Merino, thus gives more of the dual-purpose sheep, so far as it is possible to obtain a sheep with these qualities in combination. This limitation, as a general principle, applies also to other classes of live stock.

The diagram further shows that, as compared with the Lincoln-Merino, Leicester-Merino wool does not vary to nearly the same extent. Between the Lincoln and the Leicester there are practically only four counts. But this difference is very significant. It took the most famous breeder the Old Country has known nearly fifty years to produce and perpetuate the difference in conformation, quality, and constitution which causes this apparently slight numerical difference, and this difference has been maintained as a standard in the breed right up to the present day.

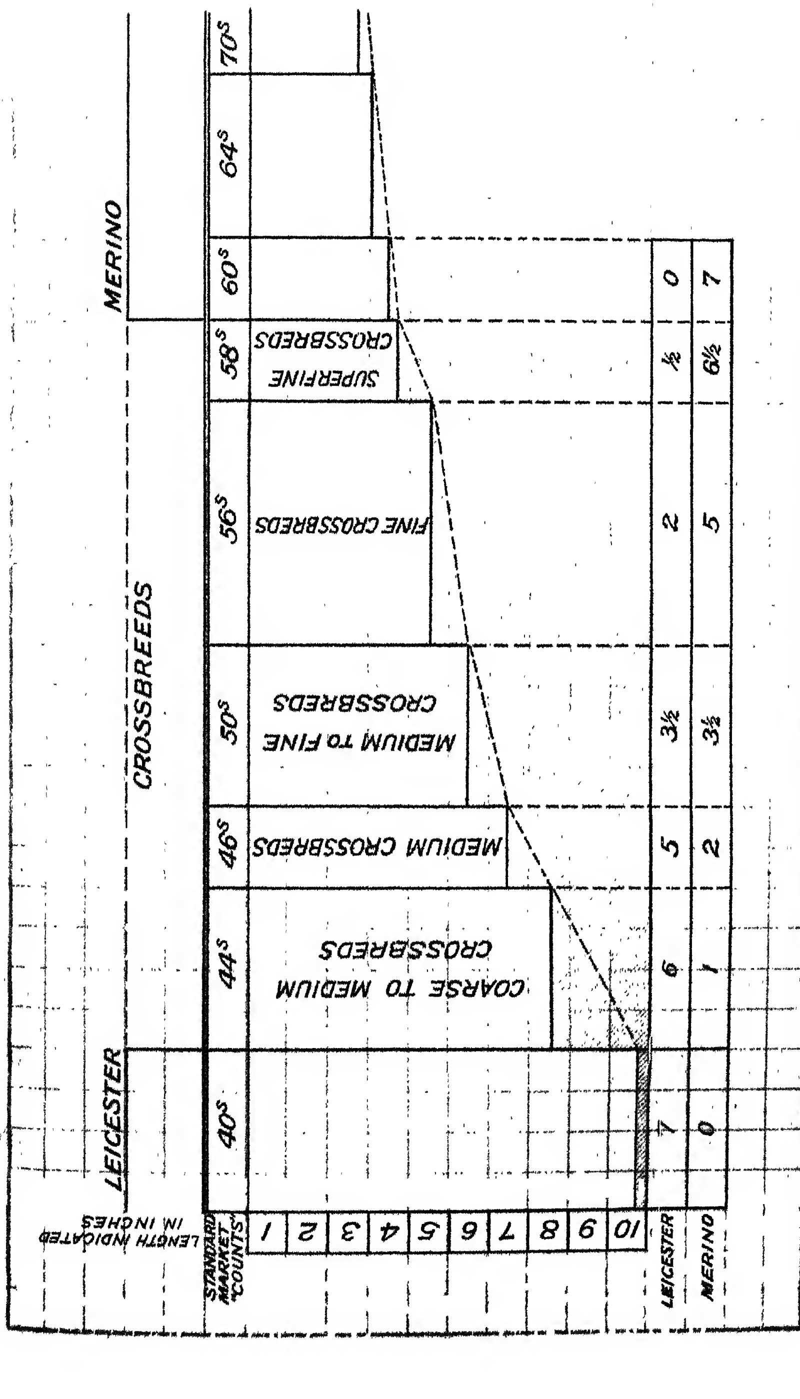


Diagram II, showing comparative length of staple proportionate to quality in wool of cross-breeds between Leicester and Merino.

Border Leicester-Merino.

The Lincoln is famous for its wool production, the Leicester for its mutton. Each constitutes a very valuable type, and one eminently suited for its own particular purpose. There is another valuable breed which, in combination with the Merino, produces a sheep noted as a dual-purpose type, yielding both a fairly valuable fleece and a still more profitable carcase. This is the Border Leicester.

This sheep produces a finer fleece than the Leicester, from which it was derived. Although long famous in the Old Country, more especially in Scotland, it has only met with very tardy recognition in Australia. But when once it became known, the Border Leicester played a most important part in introducing Long-wool sheep to the notice of Australian breeders. In this respect New Zealand has shown the way to the Australian States.

Border Leicester-Lincoln-Merino, 2-tooth.

As is indicated by the diagram, the wool of the Border Leicester, as regards quality, occupies an intermediate position between Lincoln and Merino, though subject to some slight variation in this respect. Although of course quite distinct from the Lincoln, and especially from the Merino, its wool corresponds in quality to that of the second cross Lincoln-Merino sheep. Consistent with the quality and character of its fleece, the Border Leicester is a lighter wool producer than either the Lincoln or the Leicester. For this its heavier frame and early maturity somewhat compensate. When mated with the Merino it produces a very profitable and fairly early maturing lamb, whose carcase may readily be disposed of for the export trade.

Being essentially a dual-purpose type, its progeny, either pure or mated with the Merino, may be advantageously used in the production of wool and mutton. Because of its comparatively fine quality wool, the Border Leicester when used on the Merino produces wool of a very serviceable class, and much

more uniform in quality than is the case with other Long-wool breeds. Where lamb-raising is carried on under average Australian conditions, the Border Leicester is seen to best advantage when used with the big Merino ewe. Should the grower not succeed in disposing of the whole of the year's drop, such lambs as may be left on the place may be well carried over, since as grown sheep they will cut a fairly profitable fleece. It is only breeds of the dual-purpose type that permit of the adoption of such methods.

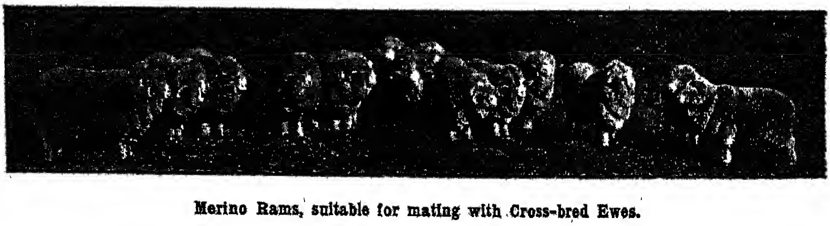
The Breeding of the Wool Type.

It has been shown that, for the production of good saleable wool, three Long-wool breeds are especially suitable. It is essential that one of these Long-wool breeds be used on the Merino before the earlier maturing mutton breeds are introduced for the raising of the early lamb. In the past it has been a common practice for growers to mate one or other of the Short-wool (Down) breeds with the Merino ewe. This calls for some discussion, and will be fully treated in the next article.

Breeders of early lambs often experience considerable difficulty in obtaining suitable strains of cross-bred ewes. This article may, perhaps, help some of our more enterprising breeders to test what promises to prove a most profitable business proposition by undertaking the breeding of the requisite cross-bred ewes. The rapid strides with which the lamb industry is advancing indicate a ready sale for such sheep.

Experiments with Breeds.

Our aim, therefore, is to thoroughly investigate the factors determining length and quality of fleece as related to size of frame and early maturity. For instance, an answer will be sought to the question of whether the Border Leicester, with its finer wool and body, is more profitable than the Lincoln, with its coarser wool and heavier fleece, for mating with the Merino. At the State Experiment Farms at Wagga, Cowra, Bathurst, and Glen Innes, experiments are now in progress with Lincolns, Leicesters, Border Leicesters, and, at Glen Innes, Romney Marsh sheep, with a view to a definite settlement of these points.



Merino Rams, suitable for mating with Cross-bred Ewes.

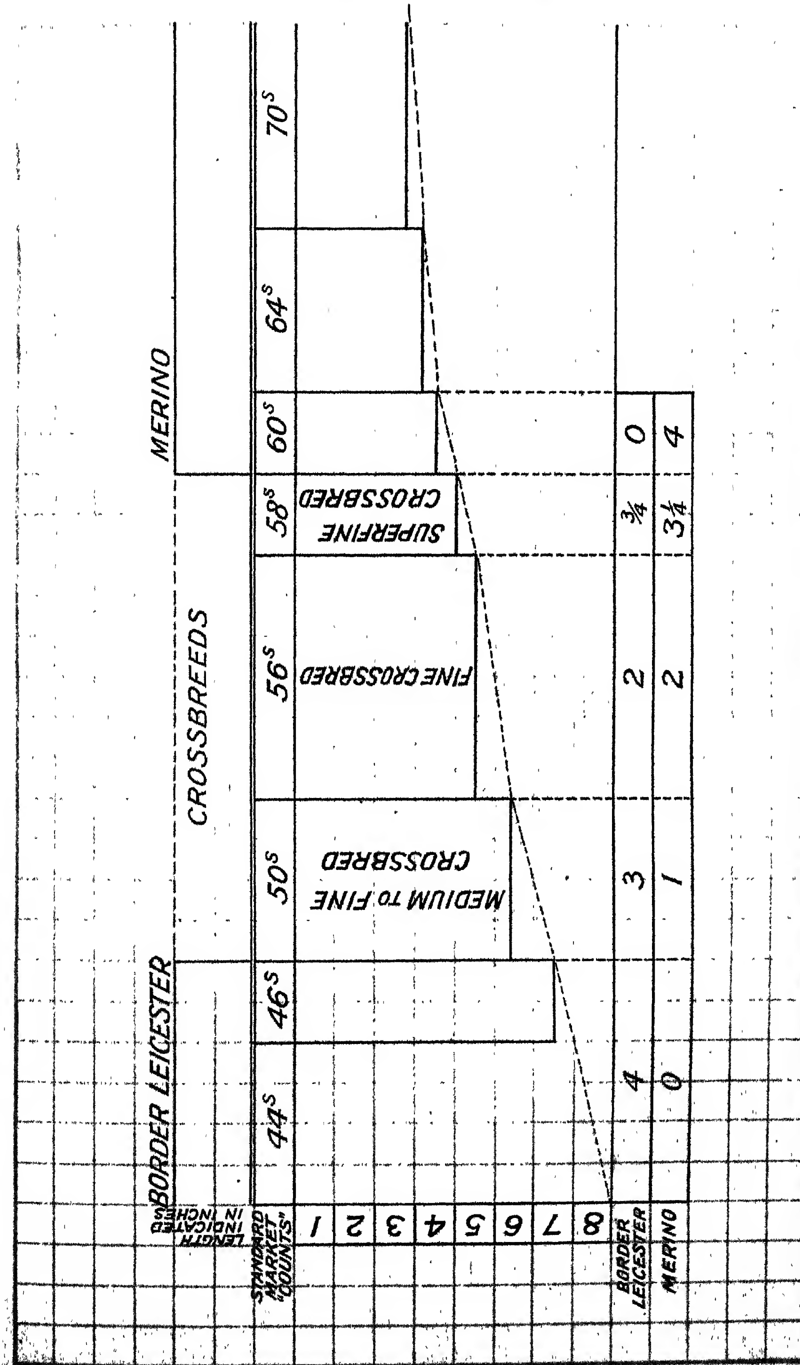
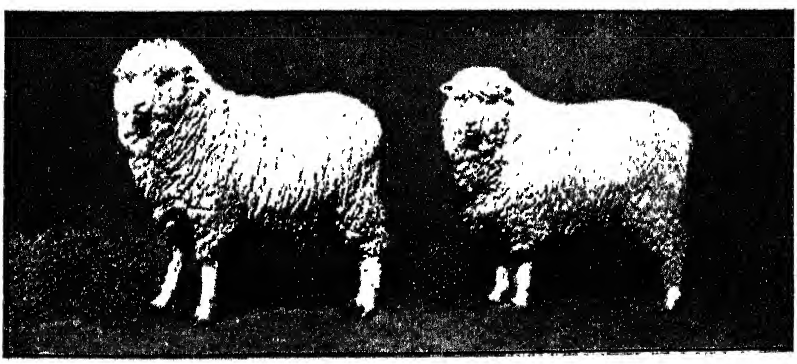


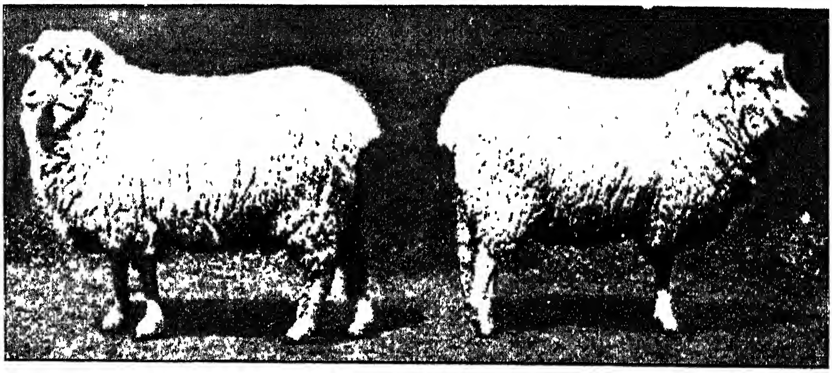
Diagram III, showing comparative length of staple proportionate to quality in wool of cross-breeds between Border Leicester and Merino.

Lincoln-Merino, 4-tooth.

Lincoln-Merino, 2-tooth.



Cotswold-Merino, 2-tooth.



Border Leicester-Merino, 4-tooth.

Border Leicester-Merino, 2-tooth.

Group of Cross-bred Sheep, various breeds, Wagga Experiment Farm.

Ophthalmia.

T. G. PALGRAVE, M.R.C.V.S., Government Veterinary Surgeon.

OPHTHALMIA may be defined as an inflammatory affection of the eyes and adjacent parts. It attacks all domesticated animals, but chiefly horses, cattle, and sheep; frequently assuming an infectious form, and spreading through a stable, herd, or flock with great rapidity. In fact, it is so often apparently infectious that it is wisest to treat every outbreak as such, and to isolate the affected animal, when practicable, at the earliest opportunity.

Certain methods of treatment, which have been found to give good results, are recommended in subsequent remarks on the disease, and in each case the recommendations have been made as simple as possible, the difficulty in treating large numbers of animals being thoroughly recognised. Some readers may, however, find it impossible to apply the treatment exactly as recommended, but in such cases the alternative is to follow the lines laid down as nearly as circumstances and the environment of the animals affected will permit.

In regard to valuable horses, cattle, or stud sheep, treatment should always be persisted in, as it must be borne in mind that at the outset the disease is comparatively easily checked; whereas if neglected, it gives rise to serious trouble and great difficulty in effecting a cure; in fact, recovery may only be partial, and serious after-effects will remain. Therefore, recourse to treatment in all cases as early as possible is strongly advocated.

Causes.

Hay, or grass seeds, grains of sand or dust, or other minute particles of matter gaining access to the eye. Injuries, such as blows from a whip, a branch of a tree, a rope-end, or other likely instrument. Prolonged exposure to sun-glare, cold winds, or rain, may induce the disease, or it may be introduced on to a farm through the medium of a newly-purchased animal affected with ophthalmia.

Symptoms.

At first, there is a discharge of tears from the eyes; the eyelids are swollen, tender, and wholly or partially closed, and the membrane lining them is inflamed and red in colour. The discharge from the eyes is sometimes tinged with blood, and changes in three or four days from a watery fluid to one that is thick, and whitish or yellowish in colour, often containing pus (matter), which collects in masses inside the eyelids and along their edges, and in the inner corner of the eye, gluing the eyelids and eyelashes together, and

making it impossible for the animal to separate the eyelids without assistance. The haw of the eye projects more than usual, and there is marked dislike to light, the animal shrinking from any kind of light, natural or artificial.

In a good many cases, the front of the eyeball is covered by a whitish film, in which an ulcer will at times form. This ulcer may eventually eat through the front of the eyeball, causing loss of sight in the affected eye. There is often fever and constitutional disturbance, the sick animal goes off its feed, and separates from the others, and in milking cows the amount of milk given is much decreased. One or both eyes may be affected.

Treatment.

Separate all affected animals from the healthy ones, and keep them apart. Remove any irritating body, such as grass-seed, which may have obtained entrance to the eye; this is best done with a soft, clean feather, or with a clean camel's hair brush. The patient should be kept in a cool, dark box or shed whenever possible.

Give an active purgative in all cases, such as a pint to a pint and a half of raw linseed oil for a horse, a pound of Epsom salts for a cow, and 6 ounces of Epsom salts for a sheep. The Epsom salts can be given dissolved in warm water, with a little ground ginger added. After the purgative has acted, give the following dose night and morning:—One ounce of hyposulphite of soda, and a quarter of an ounce of nitre, for a horse; double these quantities for cattle; and a quarter of an ounce of hyposulphite of soda and a dram of nitre for a sheep. The medicine may be conveniently given dissolved in the animal's drinking water.

The eyes should be bathed night and morning, or, preferably, with greater frequency, for half an hour at a time, with a warm strong solution of boracic acid. The lids, when stuck together, should be gently separated and their edges smeared with vaseline. A piece of soft white cotton or calico should be hung over the eyes with tapes, and kept constantly damp with the boracic acid solution; this will serve as a protection against light, dust, and flies.

After bathing the eyes, a little of any one of the following lotions may be applied night and morning, the mode of application being to drop the lotion into the eye by means of a glass syringe, a small sponge, or a piece of soft rag. Whichever is used it must be absolutely clean:—

Mercuric chloride	1 grain
Distilled water	10 ounces;
or	
Salycilic acid	5 grains
Distilled water	10 ounces;
or	
Sulphate of zinc	20 grains
Distilled water	10 ounces.

If in addition to the eyeball becoming covered with the so-called white film, an ulcer also forms, the case will be prolonged, and a variation of the

treatment will be required. It will then be necessary, after all signs of inflammation have disappeared—namely, redness, swelling and tenderness of the eyelids—and the discharge from the eye has ceased, to apply a little of the following ointment night and morning:—

Yellow oxide of mercury	16 grains
Boracic acid	1 dram
Vaseline	2 ounces.

The ointment to be applied just inside the upper or lower eyelid. This treatment should be continued until the film has almost disappeared; then bathe the eye with the boracic acid solution once daily, preferably in the morning, and afterwards, instead of the ointment, apply a little of the following solution to the ulcerated part with a clean camel's hair brush:—

Nitrate of silver	6 grains
Sulphate of morphia...	2 grains
Distilled water	2 ounces.

Scottish Agricultural Commission to Australia.

During the months of October and November the members of this Commission, accompanied by Mr. W. H. Clarke, of the Commonwealth Department of External Affairs, made a tour through New South Wales, covering practically the whole of the easily accessible localities within the Eastern and Central Divisions. The time available not being sufficient to enable all the Commissioners to make the complete tour, arrangements were made so that as many as possible could inspect the localities in which they would be most interested.

The Commission consists of Sir T. Carlaw Martin, LL.D., J.P. (Chairman); Sir John R. G. Sinclair, Bart., D.S.O. (Deputy-Chairman); Mr. Alex. M. Prain (Hon. Secretary); Mr. Wm. Barber, M.A., J.P.; Mr. J. McHutchen Dobbie, J.P.; Mr. Jas. Dunlop; Dr. R. Shirra Gibb, M.B., C.M.; Mr. R. B. Greig, F.R.S.E.; Mr. Wm. Henderson, J.P.; Mr. Jas. Keith; Mr. Edward E. Morrison, M.A.; and Dr. John H. Wilson, D.Sc., F.R.S.E. They are drawn from all parts of Scotland, and are all practical farmers, or others interested in agricultural education and development; the object of their visit to Australia being to follow the course of observation and inquiry which the similarly constituted Commission followed in Denmark (1904), in Ireland (1906), and in Canada (1908).

The main subjects of study are:—Land Settlement, the Constitution and Operations of the Ministry of Agriculture, Agricultural Education and Research, Experiment Farms, Live Stock, Mixed Farming, Wheat Farming, Dairying, Sheep Farming, Fruit and Vegetable Farming, Poultry Farming, Agricultural Co-operation, Transit, Cold Storage, and Markets, &c.

The Department of Agriculture has supplied the Commissioners with information on the sections coming within its administration.

Insectivorous Birds of New South Wales.

[Continued from page 779.]

9. The Ground Lark.

THIS familiar ground bird, also known as "Australian Pipit," or "Meadow Lark," is found in all the States of the Commonwealth, including Tasmania, wherever there is any open grass land. The birds are as plentiful in the hot, dry climate of Broken Hill as in the more favoured regions near the coast; indeed *Anthus australis* is one of the most widespread species which we possess. It is a true ground bird, nesting and living most of its life upon the ground. When disturbed, it prefers to escape by running amongst tussocks and long grass rather than taking to flight, and only when hard pressed will the bird take to the wing for a short distance.

Its flight is then characteristic, and it is thus described by Mr. North:—

"It rises in a series of short, undulating flights, as if mounting an aerial stairway, uttering each time as it ascends a somewhat mournful note, pausing and dropping a few feet before it again starts its upward flight. This is repeated until the bird is at an altitude of between 200 and 300 feet, when it takes a downward flight for a short distance before descending, like a shooting star, in one bold and almost straight flight rapidly to within a few feet of the earth, above which it flies for about 50 yards before finally alighting on the ground again."

When suddenly disturbed on the nest, however, the female will rise direct into the air—a foolish proceeding which enables the nest to be easily discovered.

The Ground Lark's nest is usually built in a hollow scraped in the ground, or the footprint of cattle in soft earth, but often at the base of a grass tussock, which overhangs the nest. The rim is flush with the surface of the ground, and the nest is formed entirely of dried grasses, occasionally lined with horse-hair. In the Australian Museum, Sydney, there is a Ground Lark's nest built in an old preserving tin, found in a paddock at Campbelltown. Instances are recorded of fruit tins, broken bottles, and similar receptacles being chosen for the nest.

The food of the Ground Lark consists chiefly of insects, although stomachs procured by Mr. North in July contained also a few small seeds. Mr. Hall finds as a result of his observations that its food consists of ground-living worms and beetles (*Scarabidæ*), as well as seeds of grasses.

This is one of the native birds which we appeal to our readers to assist in protecting. Unattractive in appearance, and with no gaudy display of colours, it has not met with the wholesale destruction which has been the fate of other species of insectivorous birds, and it is still widespread throughout the State. In many districts, particularly in the west, it is the most

INSECTIVOROUS BIRDS OF NEW SOUTH WALES.

"GROUND LARK."

ANTHUS AUSTRALIS, *Vig. and Horsf.*

prevalent species to be seen at the present day. We hope that Gould's fine plate, reproduced here, will induce our people to leave the Ground Lark in this happy position, as in its unobtrusive way it is preserving the balance of Nature. Who can say what insect pests would increase and swarm into our paddocks and orchards if such natural checks as this were removed?

10. The Jacky Winter.

Much the same may be said of this unassuming little companion of the vigneron and orchardist. The Brown Fly-catcher, or "Jacky Winter," as it is popularly called in the neighbourhood of Sydney, is undoubtedly the most familiar bird in the suburbs, and perhaps in the County of Cumberland generally, whilst its habitat extends throughout the eastern half of the continent. The bird does not possess any brilliance of colour, but its note, uttered at the first break of day, is a complete answer to those who maintain that Australian birds have no song.

The Jacky Winter is a restless little creature, and is seldom still. Even when perched, its tail is repeatedly swayed from side to side, and its incessant "Peter Peter," is heard all the year round. Mr. Hall describes the method of hunting for food adopted by these birds, as follows:—

"A given area is apparently marked out, easily surveyed from a position which a pair of birds take up on suitable tree stumps. Passing insects thus run little chance of escaping the vigilant watchers, who, ever alert, dart out as the doomed prey approaches, capture it, and then return to the same stump in readiness for a second attack. This is done several times in succession, the birds meanwhile affecting (as they do all day) a lateral movement of the tail, like a cat which is about to pounce on some luckless sparrow or mouse. They also forage among the foliage in suitable weather."

These birds exhibit little fear of man; on the contrary, they seem to follow his footsteps, and are more common in settled, cultivated localities than in more remote areas.

The nest is extremely small and shallow, measuring about 2 inches externally, by ¾ inch in depth. It is constructed of fine dry grasses, sometimes interwoven with a little horse-hair, and placed in the fork of a tree. Bare, dead branches of *Eucalyptus*, *Acacia*, and *Melaleuca* (Tea-tree) are usually chosen, but sometimes saplings or branches of fallen trees are utilised. The nest would be extremely difficult to find but for the fact that the female, if disturbed, will soon return to the nest and thus indicate its position.

The following extract from Mr. North's work is sufficient to show the value of the Jacky Winter:—

"Its food consists principally of flies, small moths, and butterflies, captured while on the wing, or picked off from some tree-trunk while hovering close to it. Small beetles, spiders, and ants, too, are eaten; also the larvæ of insects; and I have often seen it pick up breadcrumbs. In orchards and vineyards it is a most useful bird, being an indefatigable destroyer of insects, and ridding the trees and vines of many pests which infest them. Although so dull coloured in plumage, its lively actions, sweet song, and useful habits, will amply repay one for the protection afforded to this ever trustful little bird, when it seeks the haunts of man."

Harness, Harness-fitting, and Repairing.

[Continued from page 953.]

A. H. E. McDONALD,
Instructor in Agriculture, Hawkesbury Agricultural College.

LIGHT HARNESS.

In the choice of light harness, whether it be sulky, buggy, van, or any other type, the same scrupulous discrimination must be exercised as in the selection of heavy harness. Too frequently the same set is used for whatever horse is driven, but, while this is quite permissible with certain parts when the horses are of average size, each must at least have his own collar, and preferably his own winkers also. Most of the other parts are adjustable to the size of the horse, and it is only necessary to make the required changes by taking up or letting out straps.

The parts are more elaborately mounted than in farm harness; but the principles underlying the fitting are essentially the same. Leather is used almost entirely, except in some van harness, in which chains are sometimes used for traces. The weight depends chiefly upon the type of vehicle used.

Winkers.

It is a matter of controversy whether winkers or bridles should be used. The arguments advanced against the use of winkers are that the eyes are enclosed, and become hot and irritated, and that the horse is more likely to be frightened by anything coming from behind. Horses, especially those used in crowded thoroughfares, are certainly less likely to bolt when worked in bridles. A full vision of everything before and behind is obtained, and the horse is not so easily frightened by anything rushing by suddenly. All drivers know that a horse is less frightened by an object coming towards him, than by one appearing unexpectedly. A further advantage is that if the head-gear happens to be rubbed off, the horse accustomed to the restricted vision afforded by winkers, becomes frightened and probably bolts, while the one used to a bridle is unperturbed. One of the main obstacles to the use of open bridles is the patience which is required in accustoming young horses to them. The winkers have a subduing effect immediately they are put on, which the bridle does not possess.

With good going horses, it matters little whether bridles or winkers are adopted; but where teams are used, and the driver has not the horse directly under his eye, winkers are necessary to prevent the horse seeing behind him. A lazy horse which can see behind, is constantly watching his driver, rather than sticking closely to business and minding where he is going. He works

well when his driver is watching; but acquires the habit of loafing when he is not. When the winkers are used, a steady pace is usually maintained.

It is claimed that winkers hide the most beautiful part of the horse—the eyes; but while this is so, many horses have heads which are not handsome, and the ungainliness is accentuated by the bridle, while winkers tone it down.

The heat and irritation caused by close-fitting eye-pieces can be prevented by using winkers with the eye-pieces thrown well outwards at the front.

The Collar.

This must fit perfectly; otherwise it causes discomfort, and frequently creates the habit of jibbing. Few horses are naturally vicious or obstinate, and in most cases the stupidity of drivers is the prime factor in the formation in them of habits alien to their nature. Jibbing can frequently be cured by the removal of the cause and by kindly treatment, especially if the handling is done by some person who has not been responsible for the trouble.

The Hames and Traces.

In light harness the hames buckle at the top and bottom, but it is more convenient to use the lower buckle. The best traces have buckles near the hames, by which they can be lengthened to suit the horse. The point of attachment to the hames should be just above the point of the shoulder, so that the movable joint between the shoulder-blade and the humerus does not receive the pressure of the draught.

If the traces are too long, the vehicle is not drawn by them, but by the backband. On the other hand, if they are too short, the shafts push the saddle-pad forward against the withers, and also draw the crupper up tightly under the tail, causing chafing.

Breast-plates.

These are used to some extent instead of the collar, but whilst little exception can be taken to them for very light work, they cannot be recommended where the draught is at all heavy. When they are used the traces interfere with the free movement of the shoulder-joint, and cause discomfort to the horse. With the ordinary collar, provided the hames are properly adjusted, the force exerted by the horse is against the portion of the collar lying against the immovable shoulder-blade, and consequently the free movement of the joint is not interfered with.

Well-built horses look well in breast-plates; but where showiness is much desired, a greater effect is gained by using the collar, especially when the horses are not well shaped. Harness covers many defects, and some horses which are little better than scarecrows look fairly presentable when well trapped.

Saddle-pads.

The shafts are supported by shaft-tugs attached to the saddle-pad. These should be long enough to suspend the shafts level with the swell of the flaps.

The pad is kept in position by a band running along the back and terminating in a crupper, and by the belly-band. The crupper should be fairly thick to avoid chafing. The breeching is also attached to this band.

The correct position for the pad is just where the withers swell upwards. If kept further back it has a tendency to slip forward, drawing the crupper too tight.

The Breeching.

The right position for the breeching is about 3 or 4 inches below the hip joints. Here it does not interfere with the action of the horse, and he is able to throw his whole weight into it if necessary. If allowed to drop down too low it causes irritation, and may lead to kicking.

The breeching-straps should not be buckled too tightly, or the breeching will interfere with the free action of the hindquarters and also cause kicking. It should be just so tight that when the horse is fully extended it does not tighten on the legs.

Kicking-straps.

Kicking-straps are required on some horses doing vehicle work. A kicking-strap is a strong leather band which is passed over the rump, and attached to the shafts just behind the breeching staples. (See Fig. 4.) The further it can be kept back towards the tail the more effective it is. It is kept in position by attaching it to the crupper.

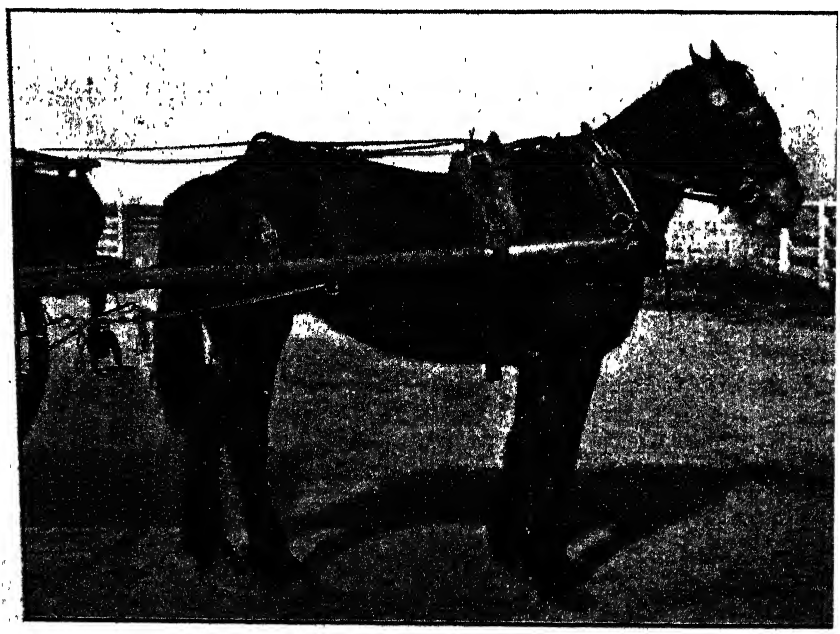


Fig. 4.—Spring-cart Harness.
Showing also the kicking-strap in use.

INSECTIVOROUS BIRDS OF NEW SOUTH WALES.

"JACKY WINTER."

MICRŒCA FASCINANS, *Lath.*

The Reins.

These sometimes consist of black leather throughout, but for the sake of cleanliness some stained leather is frequently used for the grip. They should be sufficiently long to leave a margin of about 3 feet when the horse is trotting. If too long, the loose ends are troublesome.

Bearing-reins.

It is a controversial point whether bearing-reins should be tolerated. If misused, they are an instrument of torture, but on some horses are very useful when carefully adjusted. Some are such inveterate pullers that, without the bearing-reins, they pull heavily on the hands of the driver, to his exceeding discomfort. When used, the bearing-reins are brought up and hung over a hook placed in the saddle-pad. They should be long enough to allow the ordinary free carriage of the head.

HARNESSING.

When the horse stands in the stable, the first portion of the harness to put on is the winkers. If he is not to be used immediately, the collar is put on first. The hames and saddle-pad follow. The reins must be attached to the bit before taking him out of the stable. When putting the collar on, the mane must be carefully drawn from under it, as the hair chafes the skin, and the collar must be buckled tightly. In plough harness, the straps or buckles are frequently missing from the collars, and even when present they are often not buckled. This is wrong, as the collar lies loosely and chafes the shoulder.

In adjusting the hames, they must be fitted closely to the collar right round, and the chain or strap at the lower part made such a length that they neither pinch the collar in at the top nor lie too far out from it.

The saddle-pad must be well adjusted to the back, and the belly-band drawn fairly tight. Loose girthing encourages chafing, while extremely tight girthing causes discomfort to the horse.

"Putting to."

When high-spirited animals are to be put into vehicles, two men are required. One holds the shafts well tilted while the other backs the horse in until the shafts can be slipped into the loops of the shaft-tugs. The traces are then attached to the drawing-bar, the breeching-straps buckled, and, finally, the false belly-band tightened. If a restless horse must be put in single-handed, it can only be done by backing him into the shafts carefully; if he will stand quietly, the shafts may be drawn on to him.

In double harness, each horse is brought up to the side of the pole, and the pole-straps at once buckled. Next the coupling reins are attached. After this the procedure is similar to that for single horses. When hooking the traces to the drawing-bar, the outside trace of each horse should be hooked first, to prevent him throwing his hind-quarters outwards during the process of putting in.

Errors which must be strictly avoided are putting a horse in without having the reins attached to the bit, and neglecting to buckle the pole-straps immediately on bringing him up to the pole. In taking out, the pole-straps must not be unbuckled until the last, and the reins should not be detached from the bit until the horse is in the stable. So long as the rein is buckled, it is fairly easy to reach it to check the horse should he show signs of moving off. The grip ends of the reins should be kept in the terrets of the saddle-pad until the horse is completely put to, and should be immediately replaced there on alighting to take him out.

Extreme care must be exercised in attaching double reins when driving a pair. Each rein in a double pair consists of a main rein and a branch for attachment to the bit of the opposite horse. Mistakes are frequently made by inexperienced drivers in putting the reins on, which sometimes end in disaster. If the rein is examined, it will be found that the branch is longer than the other part; but it can easily be seen which is which, without measuring. The main rein is in one piece, while the branch is buckled to it. The main rein should have holes so that the branch can be lengthened or shortened as desired. The mistake is also sometimes made of putting the branch rein through the wrong terret. The branch rein from the nearside to the offside horse must pass through the terret on the offside of the *nearside* horse. Sometimes this rein is put through the nearside terret of the offside horse and then on to his bit.

CARE OF HARNESS.

Harness perishes very quickly if neglected, but if reasonable care is exercised it will last for years. Plated harness should not be kept in the stables, as the gases arising from the decomposition of the excreta tarnish the fittings. Immediately the harness is brought in the dust should be carefully wiped off with a soft cloth or leather, and mud or sweat removed by washing with water, but on no account using too much. The bits should be well washed in clean water, thoroughly dried, and rubbed over with a little neatsfoot oil. The leather should be kept soft and pliable by using some dressing. Any one of the proved commercial compositions is suitable and cheap.

Heavy harness does not require the same attention, but it must be kept pliable and tough by oiling at regular intervals. Leather which is not treated soon becomes hard, under our dry conditions, and cracks, while the stitching decays. A very suitable dressing is pure neatsfoot oil. Some very effective and cheap mixtures are on the market for dressing heavy harness.

THE LINE OF DRAUGHT.

By the line of draught is meant the direction in which a force acts in moving a load. In practice the line of draught in ploughing lies for part of its distance in the chains. The direction may be correct or incorrect; if the latter, it means that a portion of the horse's energy is being expended

uselessly. To obtain the fullest advantage from his strength, it is necessary that the line of draught be so placed that nothing obstructs its direct action on the load.

The force exerted by the horse in traction consists of pushing. The term "pulling," although customary, is incorrect, inasmuch as a horse can only pull when he is attached to a load by the tail. The force is obtained by the propulsion of his own weight, the forward movement being due to the contraction or expansion of the muscles attached to the various bones. These bones form a system of levers, acted upon by the muscles. Propulsion can only take place when one extremity of the lever is fixed while the other is movable. This is the case with the horse. The fixed point is the foot, which is against the ground, while the movable point is the surface of the shoulder carrying the collar. In practice it is found that this force can be exerted most efficiently when the traces are attached to the hames just above the point of the shoulder (Fig. 1, page 951, November *Gazette*), provided, of course, that the proper line of draught between this point and the load is maintained.

The weight of the horse, which is very important when considering his power, becomes effective only when the body is thrown forward beyond the centre of gravity. In the horse this lies about the seventh rib, in the middle of the girth. It is evident that the heavier the shoulders, neck, and head of the horse, the greater is the force which he can exert.

This is appreciated and taken advantage of by draymen, who load their drays "heavy on"—that is, in such a way that a portion of the weight is thrown on to the horse's back. This increases the weight which can be thrown into the collar; but in loading in this way, care must be taken that the horse is not overweighted. A considerable strain is thrown upon the front feet, which rapidly causes fatigue, and may lead to injury. The weight thrown on to the horse should not be more than can be fairly comfortably lifted by raising the point of the shafts.

In light vehicles no weight should be thrown on to the back, especially on slippery roads, as the horse is more likely to stumble.

The weight can only be exerted efficiently against the collar when the line of draught is right. The feet act as a fulcrum, and the system of bones, embracing the legs, haunch, spinal column, &c., act as the lever. The weight is most effective when it acts downwards on this lever against the fulcrum. If the horse were attached to the load in such a manner that the line of draught lay above his back, the effect would be to lift him from his feet, and consequently render his weight ineffective. This occurs when a dray is loaded so "light on" that the shafts are lifted, and are only prevented from rising into the air by the belly-band. This takes a part of the horse's weight off the fulcrum (the feet), and renders it useless.

By lowering the line of draught to the horizontal, greater effectiveness would be secured, but the horse would still be unable to exert his full power.

Fig. 5.—An incorrect method of attaching leading chains to those of the rear horse.

The actual efficient angle of the correct line of draught varies according to the height of the horse, and also his length, but generally it should form an angle of about 20 degrees with a horizontal line taken through the point where the force acts on the load. In ordinary plough harness, with the chains tight and long enough to prevent the swingle-bar catching the heels, this angle places the swingle-bar just a shade lower than the hocks.

In attaching shafts to the back-chain, they must not be brought up too high, or they will be pulled downwards by the tugs, and portion of the horse's strength will be expended against his own back. The back-chain, when of the proper length, allows the points of the shafts to lie about 3 inches below the hame hooks (Fig. 3, page 953, November *Gazette*).

In team work, where horses are harnessed in tandem, inattention to the importance of securing a direct line of draught may lead to a serious loss of power. In some cases the chains of the leading horse are hooked to those of the rear horse close up to the hames (Fig. 5), with the result that the leading horse draws downwards on the chains. This means that the strength

Fig. 6.—Sulky Harness.

Fig. 7.—Six-horse Plough Team.

of the rear horse, instead of acting directly on the load, acts partly against the power exerted by the other horse, and is thus to some extent rendered ineffective.

A direct line of draught can be secured by adopting some simple arrangement. A good appliance is shown in Fig. 8. This is a simple half-inch iron bar, 12 inches in length, with a ring at each end and one at the centre. The rear chains are attached to the ring in the centre, while the upper ring is attached to the hame hook, and the lower ring receives the chains of the leader (Fig. 7).

Fig. 8.—An appliance for obtaining a correct line of draught when leading harness is used in ploughing.

Another simple and very effective arrangement, which can be fitted by anyone, is obtained by the attachment of short auxiliary chains to the rear chains to receive the leading chains. These auxiliaries are attached to the rear chains about 18 inches or 2 feet from the large end links, and are held up by short drop chains. They take the leading chains, and preserve the direct line of draught, preventing the downward pull on the rear chains.

(*To be continued.*)

Soils of New South Wales.

Part II.—The Soils of the North Coast.

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The district under consideration in this paper extends from the vicinity of Gloucester to the Tweed River, and from the mountains of the New England eastern flank to the sea. Most of the soils were, however, collected along the main coach routes, but type soils of most of the geological formations of the larger area were obtained. It was found impossible, owing to want of time, to go into the details of the geology of the area, and consequently the Geological Survey Department's map and notes constitute the only outline of the geology of the northern districts. The formations are usually extensive and uniform, and the identity of each type rock has been satisfactorily established by the Mines Department.

The climate of the North Coast allows us to divide it into two provinces—the southern, consisting of the drainage areas of the Hastings, Macleay and Manning; and the northern, of all the rivers to the north of Trial Bay.

The former area has an average rainfall of 51·99 inches per annum, of which 15·28 inches only fall in the months of summer. The latter has an average rainfall of 56·78 inches per annum, 32·6 inches of which fall in the summer months. Clearly, therefore, the northern rivers benefit chiefly from tropical rains, but the Manning–Macleay area receives a fair amount of winter rain.

These rainfalls are much in excess of the average of the South Coast, 38·87 inches, which is fairly evenly distributed throughout the year.

The southern area contains three very extensive geological formations, namely, the Carboniferous (consisting of sandstone, shale, andesite, rhyolite and tuff); the Palæozoic metamorphic rocks (consisting of slate and schist); and the Tertiary basalts. In addition there are smaller granite, limestone and alluvial areas.

The northern area contains also three great formations, viz:—The Palæozoic metamorphic rocks, the Clarence Sandstone beds, and the Tertiary basalts.

The southern area is much less rugged than the northern, a fact which is due to the small degree of folding in the Carboniferous series. It is only where intrusive igneous rocks, and hard contemporaneous bodies of volcanic rock, disturb the sedimentary measures, that great ruggedness is introduced into the landscape. In the northern area, intrusive and extrusive masses are much more abundant than in the southern, and this fact accounts mainly for the irregularity of contour of the former. The consequence is that the soils of the northern rivers are, on the average, much more leached than those of the Hastings, Macleay and Manning, this peculiarity being intensified by climatic differences.

Speaking generally, the northern area is far more productive than the southern, in spite of the leached nature of the soils. The great areas of Carboniferous sandstone between Stroud and Gloucester seem less fertile than the sandstone country around Grafton, although from chemical analysis the former would be judged the richer.

The North Coast district adjoins on the south the area known meteorologically and geographically as the Hunter Valley. The climate of the Hunter Valley is much drier than that of the Manning-Hastings-Macleay area. Thus the average rainfall of the Hunter Basin, based on the data for Muswellbrook, Murrurundi, Maitland, Newcastle, and Raymond Terrace, is 34·77 inches, rather evenly distributed throughout the year. The average rainfall of Newcastle is 47·34 inches, also evenly distributed; so that the Upper Hunter only gets a little over half the fall of the Manning-Macleay area.

The geological formations of the Hunter are also the same as those of the Manning-Macleay area, though in the former Permo-Carboniferous rocks predominate, in the latter Carboniferous. However, in the sedimentary beds of both series, sandstones, mudstones, and shales of a similar constitution play a prominent part; hence the soils also have some affinities. This fact is brought out in Table 1.

TABLE 1.—Average Composition of Soils analysed by the Department of Agriculture.

District.	Moisture. Per cent.	Volatile. Per cent.	Nitrogen. Per cent.	Lime. Per cent.	Potash. Per cent.	Phosphoric Acid. Per cent.
Hunter River, all soils (89)	3·40	6·70	·141	·239	·089	·114
" " alluvials (11)	5·98	8·45	·120	·656	·184	·214
" " Carboniferous and Permo-Carboniferous (78).. ..	2·99	6·43	·143	·180	·076	·100
Manning-Macleay, Carboniferous and Permo-Carboniferous (56).. ..	6·66	12·18	·255	143	085	·149
North Coast, all soils (294)	6·29	13·18	·256	·173	·086	·178
County Cumberland (130)	..	7·42	·136	·121	·099	·116
South Coast, all soils	5·18	10·36	·231	·217	·086	·125

The above table, as far as it deals with North and South Coasts and Hunter Valley, is compiled by averaging all the farmers' soils analysed by the Department (up to No. 2,163) under their proper headings. The County of Cumberland figures, where used in this and subsequent tables, were compiled by Mr. F. B. Guthrie some years ago. (See *Agricultural Gazette of N.S.W., Vol. IX, Part V.*) The main difference between the soils of the Carboniferous and Permo-Carboniferous areas of the Hunter and Manning-Macleay lies in the higher organic matter of the former district, an effect of climatic and topographic conditions, many swamp soils being included in the average. The lime of the Hunter soils is higher, which is due to the inclusion of several Permo-Carboniferous limestone soils in the Hunter average. In general, the soils of these two regions are very similar.

It is desirable to deal separately with each of the two areas into which the North Coast can be divided.

THE MANNING, HASTINGS, AND MACLEAY AREA.

The soils met with in the Manning-Macleay area comprise those derived from metamorphic Palæozoic rocks (Silurian ?) in the north, from Carboniferous and Permo-Carboniferous rocks in the middle and south, from volcanic rocks of all ages, and from alluvial (Tertiary and Recent) formations. The formations consist of sandstone, mudstone, shale, limestone, and conglomerate (all assignable to the Carboniferous and Permo-Carboniferous periods, mostly the former); slate, schist, chert, and granite (old Palæozoic) on the Macleay; andesite and rhyolite (Carboniferous), serpentine, diorite, basalt, and alluvial.

The formations yielding bad and indifferent soils are the siliceous sandstones, some shales and conglomerates, cherts, and schists. Schists yield, as a rule, either very gravelly shallow soils; or if they have the nature of soft phyllite, they may yield very hungry clays. Poor schist soils are much in evidence between the Hastings and the Macleay. The soils of medium or fair quality comprise those derived from tuffy sandstone, most shales, some slates, the granites, the rhyolite and andesite, and serpentine. Those of good quality are derived from diorite and basalt, and the most excellent soils are the alluvials.

At Raymond Terrace, where my coach journey practically commenced, we see excellent black alluvial soil belonging to the Hunter River flats, and very poor sandy hills of siliceous sandstone formation. Although this locality belongs to the Hunter River area, it may be said here that the alluvial soils of the Williams, Karuah, and Myall Rivers are essentially similar to those of the Hunter, and that the poorest sandstone soils of the Manning-Macleay area closely resemble those of Raymond Terrace. From Raymond Terrace to Gloucester, a variety of sandstone, shale, and rhyolite soils occur, some of which are bad or very poor, but most of medium quality; while here and there exceptionally good areas are met with. The changing nature of the underlying rocks from siliceous to marly (calcareous) sandstone and shale accounts for the differences.

The soils of the Raymond Terrace type, in spite of their great deficiency in mineral plant food, can, by proper attention and systematic manuring, be made very productive. Excellent vineyards and orchards have been made on this class of soil, the sandy texture of which allows perfect drainage and aeration. The chemically richer but more clayey sandstone soils, from the tuffy and felspathic sandstone beds, are much more difficult to work, and much more inclined to be sour than those of the Raymond Terrace type. The sourness of the former is due to the formation of an impervious clayey subsoil at no great depth.

Contemporaneously interbedded with the Carboniferous rocks of the area south of the Manning are great masses of rhyolite and andesite. These give soils which are chemically of fair quality. The rhyolites usually form very steep, rugged peaks, and ridges, like the Gloucester Buckets and Bullahdelah Buckets, so that their soils are shallow and stony.

In colour, the rhyolite soils are not unlike those of the sandstone, namely, light to grey. The andesites form dark grey, light brown, chocolate, and red soils, and as the andesitic formation gives rise to a rolling upland topography, the hills have a fair depth of soil except on the steepest parts. The soils of both volcanic series are sweet, being well drained by means of the stony subsoil.

The timbers on sandstone country around Gloucester consist mainly of an open forest of spotted gum, grey gum, stringybark, bloodwood, and in the best parts apple and box, while on poor swampy areas tea-tree and mahogany predominate. The native grasses are of good quality on the better-drained slopes and on the alluvial flats. On the stony rhyolite razorbacks, the hardy ironbark, with blackbutt and gum, are accompanied by stiff coarse grasses known as Bergalia grass, blady grass, and kangaroo grass.

The rolling hills of andesite behind Gloucester are exceedingly thickly timbered with forest timbers, including box, apple, grey gum, and fewer stringybarks, ironbarks, spotted gums, and wattles. The valleys between the andesite hills contain brush-box, turpentine, apple, tallow-wood, stringybark, and wattle. The grasses on this formation are very nutritious, and for this reason the hilly volcanic country of the Gloucester Estate is better adapted for dairying than the sandstone areas. On the sandstone formation there is reason to fear that the soil will soon be exhausted or sickened, as in many parts of the South Coast to-day ; and then the cattle will be affected with bone-chewing disease and other ailments. These ill results can of course be obviated by periodically breaking up the soil of the paddocks and by hand-feeding the cattle.

From Gloucester to Krambach the coach route passes through very good red-soil country of andesite and basaltic formation. On the whole, this is slightly better than the andesite hills between Gloucester and Copeland. The soil is good and sweet, but not very deep, and it has a stony subsoil. It is good dairying land, and would be magnificent fruit-growing country.

In various parts of the Gloucester district limestones occur. These give magnificent rich black soils covered with excellent grass, known as blue grass. The forest timbers are gum and apple.

The alluvial soils of the Gloucester and Barrington Rivers are of prime quality, and produce magnificent crops of maize and fodders, especially lucerne.

From Krambach to Tinonee, on the Manning River, the soils are reddish and yellowish, of fair quality, but rather shallow, and are derived from andesitic lava and bedded tuff. Dairying is the chief industry. Similar volcanic soils are met with on some of the hills north of the Manning between Taree and Wingham, but the dominant formations north of the river are sedimentary, of Carboniferous age, consisting of sandstone, mudstone, shale and limestone.

The Taree district limestone soils are, like those of Gloucester, of good quality, but not very extensive. The Manning River alluvials vary in colour from brown to black, and are of very rich quality. Lucerne, maize, oats,

TABLE II.—The Alluvial Soils of the Manning–Macleay.

Locality.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Capillarity.	Remarks.
Manning River, recent flood plain.	Reddish brown.	Neutral	per cent. 44½ Fair.	lb. 1,500,000	per cent. 70 Heavy loam.	per cent. 5·00	per cent. 6·99	per cent. ·196 Good.	per cent. ·572 Very good.	per cent. ·154 Satisfactory.	per cent. ·187 Satisfactory.	inches. 3½ Fair.	Excellent maize, oats, and lucerne land.
Manning River, Taree, old flood plain.	Dark ..	Acid ..	33 Low.	1,560,000	71 Heavy loam.	4·25	7·00	·126 Satisfactory.	·305 Good.	·168 Satisfactory.	·138 Satisfactory.	6 Good.	Good land for oats and maize.
Kempsey, old gravels ..	Dark chocolate.	Faintly acid.	52 Good.	1,560,000	40 Loam.	4·85	15·41	·420 Very good.	·447 Good.	·097 Fair.	·116 Satisfactory.	8 Very good.	....
Gloucester River, Gloucester.	Black ...	Acid ..	45 Good.	1,360,000	90 Clay.	6·13	12·68	·364 Very good.	·361 Good.	·225 Good.	·201 Good.	10 Excellent.	Excellent lucerne, maize, and potato land.
Karuah River (farmers' soil No. 2,255).	Dark grey.	Faintly acid	60 High.	1,360,000	84 Clay.	3·60	8·55	·182 Good.	·524 Very good.	·145 Satisfactory.	·119 Satisfactory.	10¼ Excellent	....
Average of the five above.	Dark ..	Neutral to acid.	Low to high.	1,400,000	70 Heavy loam.	4·77	10·13	·258 Good.	·442 Good.	·158 Satisfactory.	·152 Satisfactory.	7 Good.	... .
Typical West Maitland soil, Hunter Valley.	Black ..	Very faintly acid.	42 Fair.	1,700,000	60 Heavy loam.	2·95	3·98	·070 Fair.	·616 Very good.	·132 Satisfactory.	·192 Satisfactory.	10 Excellent.	Quoted for comparison.
Average of farmers' soils of Hunter basin.	Dark ..	Neutral to faintly acid.	Fair to good.	1½ millions.	Clay and heavy loam.	5·98	8·45	·120 Satisfactory.	·656 Very good	·184 Satisfactory.	·214 Good.	Good.	Quoted for comparison.
Average of farmers' soils, Manning-Macleay area (15).	Dark ..	Neutral to acid.	Fair to good.	About 1½ millions.	Heavy loam to clay.	8·20	15·59	·293 Good.	·316 Good.	·087 Fair.	·174 Satisfactory.	Good	Quoted for comparison.

potatoes, all seem to thrive with equal excellence on soils which have been cultivated many years, and have never been manured.

The soils derived from the sedimentary Carboniferous rocks are similar to those around Gloucester on the same beds. They extend from Cundle to the Comboyne Range, and in a north-easterly direction nearly to Port Macquarie. Much of the coastal strip on this formation is covered with great swampy tracts and salt marshes, on which, as a rule, the soil is above the average in quality and produces abundant fodder; but a deficiency in lime is characteristic even of these tracts, and cattle grazed on them continuously are apt to contract osteomalacia.

The volcanic rocks of the Comboyne Range consist of rhyolite, andesite and basalt. The range is clad with a dense sub-tropical jungle, and has a fine reddish, loamy soil. The Comboyne Range is one of the most productive little tablelands of the northern districts, but for want of roads there is not much settlement as yet.

The metamorphic rocks of the Upper Manning were not visited, but are continuous with those which come in between Port Macquarie and Kempsey. The latter give poor, light-coloured soils in some areas, and poor gravelly soils in others. The country which they cover will never carry much stock, and will need heavy manuring to stand cultivation. This portion of the district is therefore as yet very sparsely peopled, the timber industry alone being of importance. On the ranges and in the hilly country, gum, ironbark and blackbutt are the chief timbers; and in the valleys, box, tallowwood, and wattle are interspersed with the others.

The basalt areas of the Manning are partly forest and partly scrub land. They have excellent soil and fine timbers, both hardwood and softwood (gum, box, pine, &c.).

At Port Macquarie we have an interesting red-soil area over serpentine and diorite. Although the red serpentine soils maintain chemically very fair quality, they are nevertheless not always well adapted for cultivation and dairying. This is probably due to the abundance of magnesia and manganese, both injurious to plant life, concentrated in the soil in many places. The Port Macquarie red soil is so rich in iron oxide that in several spots it is bagged and sent to Sydney and elsewhere for gas purification purposes. Blackbutt is the dominant timber on this formation. Peaty teatree swamps are also abundant in this area; and on the chert, schist, and quartzite formations of Port Macquarie, a clayey grey soil covers the flats and carries a mixture of tea-tree, swamp-oak, and apple.

Along the coast are sandy peat swamps and melon-hole plains, covered with tea-tree and grass-tree. These overlie a consolidated sand of Tertiary raised-beach formation. Cathie Swamp is one of these. The subsoil here is sandy and the surface peaty.

The only other formations to be specially mentioned in the Manning-Macleay area are the Tertiary gravels around Kempsey, which generally have

TABLE III.—Typical Carboniferous Sandstone Soils of the Manning–Macleay Area.

Locality.	Position.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.
Gloucester	Hilltop .. .. Subsoil gravelly clay.	Light ..	Strongly acid.	per cent. 29 Low.	lb. 2,000,000	inches. 4 Fair.	per cent. 38 Loam.	per cent. 2·09	per cent. 6·88	per cent. ·126 Satisfactory.	per cent. ·164 Satisfactory	per cent. ·109 Satisfactory.	per cent. ·061 Fair.
Gloucester	Small gully .. Subsoil gravelly clay.	Light ..	Strongly acid.	36 Fair.	1,800,000	6 Good.	56½ Loam.	1·54	3·81	·112 Satisfactory.	·096 Indifferent.	·116 Satisfactory.	·072 Fair.
Average	....	.. ...	......	......	......	5 Good.	47 Loam.	1·81	5·34	·119 Satisfactory.	·130 Satisfactory.	·112 Satisfactory.	·077 Fair.

TABLE IV.—Limestone Soils of the North Coast.

Locality.	Position.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay.	Moisture	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.
Barrington River	Hill slope	Black ..	Neutral ..	per cent. 41 Fair.	lb. 1,560,000	inches. 5½ Good.	per cent. 76 Clay.	per cent. 3·51	per cent. 8·63	per cent. ·196 Good.	per cent. ·420 Good.	per cent. ·134 Satisfactory.	per cent ·086 Fair.
Taree	Flat hill	Dark grey.	.. ...	......	......	......	......	4·54	13·44	·350 Very good.	·396 Good.	·132 Satisfactory.	113 Satisfactory.
Taree (Cundle Road) .	Flat hill	Grey ..	Very faintly alkaline.	28½ Low.	1,900,000	4¾ Fair.	46½ Stony clay.	8·59	3·06	·126 Satisfactory.	·382 Good.	·049 Indifferent.	·083 Fair.
Average	....	......	......	Fair.	......	Good.	Clay	5·55	8 38	·224 Good.	·399 Good.	·105 Satisfactory.	·091 Fair.

a good, loamy, reddish-chocolate soil, and are timbered with tallow-wood, bloodwood, ironbark, stringybark, and wattle trees, many of gigantic size.

The Kempsey (Macleay) alluvial soils are deep, fertile, dark loams, and are equal in quality to those described from other rivers.

Analyses of Manning-Macleay Soils.

The *alluvial* soils of the Hunter Basin, and of the Manning-Macleay province, exhibit very close affinity. Those of the coastal province, being more low-lying and subject to a larger rainfall, contain rather more volatile matter and nitrogen than the Hunter River soils; and being for the same reason more leached, the former contain less lime than the latter. Table II shows analyses of the alluvial soils of the Manning-Macleay area.

The two typical *sandstone* soils of the Gloucester district are chemically much better provided with plant food than the sandstone soils of the Clarence Beds (Grafton district), the Nowra Beds, and even the Hawkesbury Sandstone. Nevertheless, they are less fertile, a fact due to sourness arising from a clayey subsoil, and would be more difficult to get into good condition. Table III gives analyses of these soils.

The *limestone* soils of the North Coast are of fine quality, but usually very heavy. Chemically they are much poorer than inland limestone soils (as at Tamworth), being very leached in such a wet climate as the North Coast possesses. (See Table IV.)

Table V gives the composition of the typical *volcanic* soils of the region. Those of the Comboyne Range are extremely fertile, as the native jungle indicates; yet through leaching they are less rich chemically than the others. In this respect, and in the high volatile, they resemble the Dorrigo soils. No manuring should be necessary.

Table VI shows the composition of some *serpentine*, *schist* and *sandstone* soils of Port Macquarie, and one soil of Kempsey.

The serpentine soils are not nearly so rich as they would appear to be chemically. They contain mineral constituents (manganese and magnesia which are detrimental. Near Lake Innes occurs an iron ore deposit of good quality which is derived from decomposing serpentine; and curiously, black peaty soils, with rank tea-tree and swamp-oak forest, often occur near the hill-crests. This perversion of Nature seems to be due to chalybeate and mineral springs. One soil (No. 7 of the Table) contained an appreciable amount of sodium chloride. This salt prevents bacterial action and decay of vegetable matter, and may be the cause of peaty soils existing in such elevated positions. Probably the spring carries much sodium chloride.

THE NORTHERN RIVERS.

This area contains Palæozoic metamorphic rocks (in part highly altered Permo-Carboniferous and Carboniferous) in the south and at Byron Bay in the north. The middle portion of the area consists of sandstones of Triassic age known as the Clarence Beds. Both these and the metamorphic rocks are

TABLE V.—Typical Volcanic Soils of the Manning–Hastings–Macleay Area.

Locality.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.
Gloucester Buckets— Mixed rhyolite and andesite soil; steep slopes; shallow stony soil.	Light grey	Neutral	per cent. 34 Low.	lb. 1,560,000	inches. 6¼ Good.	per cent. 55½ Loam.	per cent. 1·94	per cent. 6·38	per cent. ·210 Good.	per cent. ·266 Good.	per cent ·150 Satisfactory.	per cent. ·083 Fair.
Gloucester-Copeland Ranges— Andesite soil, hill slopes; shallow, sweet soil.	Light brown.	Strongly acid.	53 Good.	1,600,000	5½ Good.	56½ Loam.	3·17	9·15	·266 Good.	·228 Satisfactory.	·164 Satisfactory.	·123 Satisfactory.
Gloucester-Copeland Ranges— Andesite soil, valley type; deep, stony detritus.	Dark grey	Acid ..	56 Good.	1,350,000	6 Good.	61 Heavy loam.	2·99	8·79	·140 Satisfactory.	·153 Satisfactory.	·045 Indifferent.	·084 Fair.
Tinonee— Hill; andesite and tuffs	Reddish..	Strongly acid.	31½ Low.	1,600,000	4½ Fair.	50 Loam.	3·92	8·90	·182 Good.	·204 Satisfactory.	·059 Fair.	·063 Fair.
Tinonee— Hill; andesite and tuffs	Grey ..	Acid ..	40½ Fair.	1,500,000	4½ Fair.	61½ Loam.	9·68	11·73	·280 Good	·195 Satisfactory.	·058 Fair.	·078 Fair.
Taree— Basalt; hilltop	Brown chocolate.	Acid ..	49 Good.	1,100,000	1½ Poor.	69 Loam.	7·35	14·84	·462 Very good.	·214 Satisfactory.	·099 Fair.	·178 Satisfactory.
Taree— Basalt; small gully; leached ..	Dark grey	Acid ..	37 Fair.	1,500,000	3 Fair.	78½ Clay.	3·76	6·35	·154 Good.	·140 Satisfactory.	·027 Bad.	·067 Fair.
Upper Slopes, Comboyne Range— Rhyolite and andesite..	Red ..	Very strongly acid.	57 Very good.	1,300,000	10 Excellent.	69 Heavy loam.	6·72	12·06	·140 Satisfactory.	·193 Satisfactory.	·039 Indifferent.	·221 Good
Lower Slopes, Doyle's Farm, Comboyne Range— Rhyolite	Brown ..	Strongly acid.	55 Very good.	1,400,000	7½ Good.	63 Heavy loam.	5·58	15·74	·350 Good.	·088 Indifferent.	·072 Fair.	·222 Good.

capped over great areas by Tertiary volcanic rocks, chiefly basalt, and alluvials may cap them along the watercourses. Small granite areas occur in the coastal strip among the metamorphic rocks, as at Trial Bay; and larger granitic areas occur on the slopes of the New England tableland.

As in the Macleay-Manning area, the formations yielding very poor soil are the sandstones and quartz schists; those giving medium-class soil are the granites, slates, and shales; and those giving good soil are the basalts and alluvials.

To the north of the Macleay River at Kempsey, the main northern coach route passes for several miles through rich, loamy alluvial lands, used at present for dairying, maize, potatoes, lucerne, oats and other crops. I am informed that few of the farmers manure at all, although the land has been under cultivation for many decades. The Kempsey alluvial soils are chemically rich, in an ideal mechanical condition, very deep, and provided with excellent natural subsoil drainage. The good quality of these alluvials might be attributed to the fact that granite, slate, limestone, and basalt all have contributed to their formation.

When we leave the Macleay alluvials we pass in a northerly direction over a couple of miles of granitic formation, part of the Trial Bay-Smoky Cape mass. This yields also a really good soil.

Thence, about 10 miles from Kempsey, the road to Macksville runs through slate formation which yields soils of fair quality, but rather shallow and provided with a stony subsoil. The slate country is very heavily timbered with hardwood, and being inferior as compared with the alluvials, it is not yet utilised to any marked extent except for timber-getting and cattle runs. Most of it is, however, well adapted for fruit-growing, and should, if rendered available to the *bonâ fide* tiller of the soil, carry a prosperous population. When cleared it is not bad grass land. The soils are dark grey, chocolate, red, yellow and brown, varying in colour according to the particular class of slate outcrop which they overlie. The typical soils taken at Macksville are fairly representative of this formation.

Excepting the river alluvials of the Nambucca and Bellinger Rivers and the coastal marshes, much the same class of country lines the coach route to Bellingen, and thence to Coff's Harbour and Nana, a few miles north of which the Grafton (Clarence) sandstones commence.

The strip of metamorphic rock is not very wide north of the Nambucca, for to the west lies the Dorrigo tableland, consisting mainly of basaltic rocks.

The Dorrigo tableland is partly covered with jungle (scrub) and partly with box-gum forest. In places near the watercourses, small open flats entirely untimbered in the virgin state, present a remarkable puzzle to the naturalist. These flats are well watered, and the soils are the same red soils as elsewhere, and do not exhibit any chemical defects other than those possessed by the rest of the Dorrigo soils.

Three kinds of soil exist on the Dorrigo—the red, the chocolate, and the yellow. The two first are closely related, and are of basalt derivation; the

TABLE VI.—The Soils of Port Macquarie District—Serpentine, Schist, Chert, and Sandstone.

Formation.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
Light-coloured, Serpentine on hill (town area.)	Grey ..	Strongly acid.	per cent. 44 Fair.	lb. 1,600,000	inches. 7¾ Good.	per cent. 55 Loam.	per cent. 2·20	per cent. 9·41	per cent. ·224 Good.	per cent. ·172 Satisfactory.	per cent ·072 Fair.	per cent ·047 Indifferent	....
Dark Serpentine on hill (town area).	Red .	Very faintly acid.	54 Good	1,600,000	12 Excellent	59 Loam.	4·33	13·89	210 Good.	·239 Satisfactory.	·041 Indifferent.	·091 Fair.	Manganese oxide ·040 per cent. Magnesia ·184 per cent
Swampy gully overlying Serpentine (town area).	Yellow .	Very faintly acid.	54 Good.	1,100,000	6 Good.	55 Loam.	3·96	17·48	·350 Good.	·110 Satisfactory.	086 Fair.	·123 Satisfactory.	.. ..
Lake Innes; dark ironstone—derived from Serpentine.	Brown .	Faintly acid.	33 Low.	1,300,000	7 Good.	83 Clay.	5·56	17·55	·336 Good.	·330 Good	·045 Indifferent	·107 Satisfactory.	Manganese oxide ·100 per cent. Magnesia 231 per cent
*Lake Innes; quartzite and schist formation. Compare Kempsey metamorphic (†)	Grey ..	Strongly acid.	54 Good.	1,250,000	5½ Good.	87 Clay.	2·58	9·08	·070 Fair.	·150 Satisfactory.	·081 Fair	·054 Fair	....
Cathie Swamp; Raised-beach Swamp.	Dark grey.	Strongly acid.	52 Good.	1,350,000	7 Good.	26 Light loam	2·47	11·91	·266 Good.	·058 Poor.	·041 Poor.	·038 Poor.	Peaty soil.
Port Macquarie Ironstone; farmer's soil, No. 2,234	Black ..	Strongly acid.	153 High	500,000	3 Fair.	48 Loam.	34·42	31·31	·910 Excellent	·322 Good.	·062 Fair.	·398 Good.	Peaty soil. Chlorine 015 per cent.
†Kempsey Metamorphic rocks. Compare (*).	Light brown.	Very strongly acid.	59 Good.	1,400,000	5 Fair.	66 Heavy loam.	4·65	11·48	·196 Good.	·062 Indifferent	·061 Fair.	·087 Fair	....

last is probably derived from bedded tuffs, but I have seen no outcrop to confirm the surmise, which is based wholly on the pulverulent mechanical condition of the soil, so like that of the tuff soils of Samoa.

The Dorrigo soils on the tableland proper are deep and fertile, yet the majority of the red and chocolate soils and all the yellow soils exhibit chemically a marked deficiency in lime (soluble in concentrated hydrochloric acid). In a few localities a soil containing from ·5 to 1·5 per cent. of lime is obtained. It appears that the Dorrigo soils must be classed as leached humus soils, and as the organic matter is reduced by clearing and cultivation it is likely that the lime percentage will increase; but it is also likely that the fertility will diminish with decrease of humus and increase of lime, since the organic acids in the soil preserve an ever-sufficient supply of immediately available plant food in solution, lime included. The underlying rock is rich in lime silicates. After clearing, the leaching out of water-soluble plant food will continue by virtue of good rainfall and elevated position; but it is questionable whether the soil water will be able to maintain a sufficient amount of such food, the rapid solution by organic acids being checked. The soils of the Comboyne Range and of the Tweed River hills exhibit the same characteristics due to leaching.

The timbers of the coastal slate country are much the same from Kempsey to Nana. Blackbutt, red gum, bloodwood, stringybark, and wattle are everywhere, and on the hills with the deepest soil, tallow-wood, brush-box, and turpentine also abound. In swampy regions, tea-tree and oak are always found, and on the flats below the ranges box accompanies apple, brush-box, and gum. In scrubby places (vine jungle), cedar and pine come in. Ironbark occurs sparsely on stony ridges. Blackbutt and ironbark are, generally speaking, indicative of poor, stony soil; tallow-wood, bloodwood, and stringybark of deep, loamy yet poor soil; turpentine, pine, brush-box, and cedar of the best class of soil.

The native grasses of the slate country are coarse in the virgin forest (kangaroo and blady grass), but become very good on the cleared country. Paspalum thrives on the slate formation, and has been sown on large areas.

The Dorrigo scrub country carries the usual softwood timbers—pine, sassafras, leather-jacket, rosewood, fig, and beech. On the yellow soils a kind of beech known as "Niggerhead" is particularly abundant.

The Clarence Beds area, omitting the river alluvials within it and the basaltic cappings covering it in many parts, is of poor quality. It is derived mainly from a very siliceous Triassic sandstone. A number of soils of a similar nature but differently timbered were collected and analysed. The valleys alone are intensely cultivated. The ridges are mainly used as cattle runs, and would require heavy manuring for cultivation with successful results.

North of the Clarence sandstones, and extending from Casino to Lismore, we have a magnificent stretch of volcanic (basalt) country, with red and brown soils. This constitutes one of the most fertile areas of the State, but is unfortunately to a large extent held in big holdings, too extensive for the

TABLE VII.—Alluvial Soils of the Northern Rivers.

Locality.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay.	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
South Arm, Nambucca River.	Dark ..	Very strongly acid.	per cent. 62 High.	lb. 1,250,000	inches. 7 Good.	per cent. 88·2 Clay.	per cent. 2·65	per cent 7·77	per cent. ·434 Good.	per cent. ·100 Satisfactory.	per cent. ·113 Satisfactory.	per cent ·117 Satisfactory.	Fine oats and maize country.
North Bank of Nambucca, Macksville.	Yellowish.	Acid .	65 High.	1,100,000	2½ Poor.	91 Clay.	2·89	10·22	·336 Good.	·258 Good	·089 Fair.	·145 Satisfactory.	Maize and oats.
Creek 9 miles from Grafton, Copmanhurst-road	Dark ..	Strongly acid.	52·7 Good.	1,325,000	8 Very good.	92 Clay.	3·80	11·26	·098 Fair.	·396 Good.	·234 Good.	155 Satisfactory.	Maize and potatoes.
Gully at Copmanhurst ..	Black ..	Acid .	51 Good.	1,350,000	10 Excellent.	76½ Clay.	2·20	9·75	·098 Fair.	·408 Good.	·171 Satisfactory.	·261 Good.	....
Average	Dark ..	Strongly acid.	Very good.	....	Good.	Clay.	2·83	9·75	241 Good.	·291 Good	·153 Satisfactory.	·154 Satisfactory.	....

best utilisation. In addition to the excellence of the soil, this region has an excellent and well-distributed rainfall. Dairying is at present the main industry, but in time to come this district promises to surpass all others in the output of agricultural produce.

Analyses of Northern Rivers Soils.

Analyses of the typical soils collected are shown in Tables VII to X.

Table VII deals with the true *alluvial* soils. It will be seen that these maintain, as far as chemical composition is concerned, the usual excellence of river alluvials (*cp.*, Table II). The Nambucca alluvials are rather more clayey than those of the Macleay and Manning, and they are not so well supplied with lime. These characteristics are easily accounted for by their origin, all the rocks of the Nambucca basin being clay slates. Corn (maize), oats, lucerne, and potatoes are, as usual in the northern districts, the main crops of the farmers of these lands. Dairying is the main industry.

No manuring is attempted on the cultivated alluvial land, the greatest need of which, after some years of cropping, is organic matter and humus. The importance of periodically resting the land, of green-manuring, and of rotation of crops, has not yet dawned on many North Coast farmers.

Table VIII gives the type *slate* soils of the Northern Rivers. They are chemically of only fair quality, and as a rule their depth is only from 6 to 12 inches, below which a stony clay constitutes subsoil. Owing to the steep bedding of the slaty rocks, drainage is generally good. The slate country, consequently, is exceedingly well adapted for vineyards and orchards of stone fruit, and citrus fruits also do well in most places. When cleared and burnt off, the land is very suitable for paspalum, which now covers many slaty hills around the Nambucca and Bellinger. Care must be taken on these soils that they are not altogether depleted of organic matter by overstocking. The deterioration which has taken place on the South Coast may be expected here too in time, if precautions are not observed.

The North Coast slate soils are on the average both better in quality and deeper than those of the South Coast, but if denuded of timber and frequently burnt off, the heavy rains may rapidly cause washaways and remove the soil on the more hilly country.

Table IX gives us the *sandstone* soils of the Clarence Beds. They are a poor lot chemically, but in excellent mechanical condition, so that they will respond very readily to all manures. They are usually deep, and on the hills and ridges, and in the undulating country generally, they are so well drained and aerated naturally as to produce very sweet grass and excellent crops of any cultivated fruits. Both chemical manures and organic matter are desirable in the cultivation of these soils.

The small creeks in the Grafton district often have splendid alluvial soils which produce finer crops of corn and potatoes than even the river silts, a fact which must be attributed to the excellent mechanical condition.

The worst country by far in this area is that formed by peaty tea-tree swamps, and sour sandy tea-tree and grass-tree marshes. This country is

TABLE VIII.—Slate Soils of the Northern Rivers.

Locality.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay.	Moisture.	Volatile	Nitrogen.	Lime.	Potash.	Phosphoric Acid.	Remarks.
1 mile from Macksville (ridge).	Dark ..	Very strongly acid.	per cent. 54 Good.	lb. 1,400,000	inches. 6 Fair	per cent. 56½ Loam.	per cent. 3·68	per cent. 12·77	per cent. ·294 Good.	per cent ·232 Satisfactory.	per cent. ·080 Fair.	per cent. ·084 Fair.	Subsoil below 12 inches, gravelly loam.
Cemetery Hill, Macksville	Light grey.	Strongly acid.	49 Good.	1,350,000	5½ Fair.	79½ Clay.	3 07	10·45	·210 Good.	·145 Satisfactory.	·019 Indifferent.	·074 Fair.	Subsoil yellow; gravelly clay at 10 to 12 inches.
Scrubby Hill, north of Nambucca River	Chocolate	Strongly acid.	49 Good.	1,425,000	7½ Good.	75½ Clay.	4·42	12 82	·520 Very Good.	·120 Satisfactory.	·107 Satisfactory	·150 Satisfactory.	Subsoil below 12 inches, gravelly clay
Coff's Harbour; felsitic slate ridge.	Light grey.	Strongly acid.	63 Very good	1,100,000	6 Fair.	69 Heavy loam.	3 13	10·22	·252 Good.	·190 Satisfactory.	·081 Fair.	·087 Fair.	Subsoil below 6 inches, yellow clay.
Coff's Harbour; dark slate ridge.	Red brown	Acid	57 Good.	1,250,000	11 Excellent	80 Clay.	6·88	12·01	·196 Good.	·108 Satisfactory.	·058 Fair.	070 Fair.	Subsoil, 12 inches deep, red clay.
Valley in slate formation, Coff's Harbour.	Yellow ..	Strongly acid.	61 Good.	1,400,000	6½ Fair.	84 Clay.	4·15	7·84	·168 Good.	·100 Satisfactory	·177 Satisfactory.	·100 Satisfactory.	Subsoil below 12 inches, yellow clay
Average	....	Very acid	Good.	....	Good.	Clay.	4·22	11·02	·274 Good.	·149 Satisfactory.	·092 Fair.	·094 Fair.	....

useless for both dairying and cultivation without draining, and over wide areas of this kind draining is prohibitive in cost or impossible. Between Grafton and Casino there is much country of this type, and it is not even of any use to the timber-getters.

Table X gives some idea of the *volcanic* soils of the Northern Rivers. The volcanic soils analysed specially have been mostly from hilly country and tablelands where much leaching has taken place. The volcanic areas were in the native state largely covered with vine scrubs (tropical jungle). This kind of country ranks next to alluvial in fertility, and paspalum grows luxuriantly on it as soon as it is burnt off. The chemical deficiency in lime caused by leaching is not likely to be detrimental as long as the supply of humus is kept near the natural quantum

The more level areas between Casino and Lismore are, of course, not so leached as the highlands of Dorrigo, nor as liable to be impoverished from any cause.

All the leached volcanic soils of the Northern Rivers are red, light chocolate, or yellow in colour. The unleached and extremely rich soils are dark brown and black.

GENERAL NOTES.

Some matters introduced into my remarks on the South Coast soils (*Agricultural Gazette*, February, 1910) deserve reiteration here :—

1. The destruction of the jungle which flanks the tablelands of Comboyne and Dorrigo should be strictly prohibited, not only in the interests of all the population of these areas, but especially in the interests of those selectors whose lands embrace a portion of the slope. When the jungle on the higher slope is interfered with, not only is the land impoverished by the rapid removal of soil waters containing plant food, but the soil itself washes away rapidly. A whole holding may soon be rendered useless in this way. Hilgard quotes instances of whole districts having had to be abandoned for this reason in the American States.

2. Leaving a certain amount of jungle on the flanks of the ranges may also preserve, to some extent, the fair and equable rainfall which the Northern districts now enjoy. Though geographical position ensures for them a good rainfall for all time, wholesale clearing of the scrubs is sure to cause the rains to come in sudden heavy showers, instead of steady falls. Heavy sudden storms cause great washaways in cleared upland country, and silt up the rivers.

3. Ringbarking on poor clayey country, as on slate and shale formations, is waste of money unless the landowner is prepared to keep clearing the thick forest of saplings which spring up in such country when ringbarked.

With proper precautions taken by the Government and the people themselves to prevent the skinning of the country, the North Coast is a region of immense possibilities. It is a region of good rainfall and of good soils. Even the poorer soils have frequently valuable attributes, such as good

TABLE IX.—Sandstone Soils, Grafton District.

Locality.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay.	Moisture.	Volatile.	Nitrogen	Lime.	Potash	Phosphoric Acid.	Remarks.
Copmanhurst	Light ..	Faintly acid.	per cent. 34·7 Low.	lb. 1,732,000	inches. 9 Excellent.	per cent. 39 Loam.	per cent ·94	per cent. 4·50	per cent. 091 Fair.	per cent. ·116 Satisfactory	per cent. 039 In-different	per cent. ·064 Fair	Spotted Gum.
Copmanhurst	Light ..	Strongly acid.	28 Low.	2,050,000	9 Excellent.	11·3 Sand.	·42	5 70	098 Fair.	·039 Deficient.	046 In-different	·049 In-different.	Peppermint country.
Copmanhurst	Light ..	Acid.	30 Low.	2,000,000	9 Excellent.	8·9 Sand.	·24	2 60	·091 Fair.	060 Deficient.	033 In-different.	·064 Fair	Bloodwood.
Copmanhurst — Grafton road.	Light ..	Very strongly acid.	36½ Fair.	1,832,000	9 Excellent.	22 Light loam	·55	3·95	·098 Fair.	·024 Bad.	·043 In-different	·064 Fair.	Tallow-wood.
Peaty Flat, Copmanhurst—Grafton road.	Dark ..	Very strongly acid.	33 Low.	950,000	4 Fair.	85·6 Clay.	5 34	23 71	·462 Very good	·110 Satisfactory.	·081 Fair.	·124 Satisfactory.	Tea-tree.
Whiteman's Creek Flats	Light ..	Very strongly acid.	33 Low.	1,900,000	8½ Very good	22 8 Light loam.	·45	1·76	0 98 Fair.	·058 Deficient.	·039 In-different.	·054 Fair.	Apple and Blue Gum
Hill 10 miles from Grafton, Copmanhurst-road.	Light ..	Very strongly acid.	38 Fair.	1,700,000	9 Excellent.	21·5 Light loam.	·50	1·96	·098 Fair.	·048 Bad.	·163 Satisfactory.	·045 In-different.	Grey Gum, Red Gum, Mountain Ash
Ridge 7 miles from Grafton, Copmanhurst-road.	Light ..	Strongly acid.	32·7 Low.	1,700,000	11 Excellent.	27 Light loam.	1·66	7·55	·154 Good.	·119 Satisfactory	042 In-different.	·072 Fair.	Ironbark, with Spotted Gum and Bloodwood.
Flat land 6 miles from Grafton, Copmanhurst-road.	Light ..	Very strongly acid.	32·7 Low.	1,900,000	9¾ Excellent	24 8 Light loam.	·34	1·60	·098 Fair.	018 Bad.	·095 Fair.	·027 Bad.	Spotted Gum.
Average of 8 Sandy Sandstone Soils.	Light ..	Very strongly acid.	Low.	1,750,000	Very good	Light loam.	·64	3·70	·103 Satisfactory.	·060 Deficient.	·063 Fair.	·055 Fair.	....

drainage and mechanical condition, which gives them a value. The North Coast abounds in valuable timbers, belts of which should be reserved in areas that should not be tilled nor cleared.

Unfortunately, in a new country there is a tendency to skin it of all its wealth as quickly as possible without any thought for the future. Timbers of great value are cut down and burnt wholesale. Flanks of tablelands and slopes of ranges are cleared and burnt with no thought of evil consequences, such as washaway of soil, impoverishment of the soil, and exposure of the tableland to the danger of bush-fires from below. Land is overstocked and in time sickened or exhausted, and then cattle diseases become rampant. Alluvial lands are planted with the same crops year after year without rest, manuring, or change of crop, until it is sickened. These are the evils which the State can diminish by education and precept, by forestry laws and care in not alienating lands which it is stupid to clear; and they are evils which farmers' societies and progress associations can also do much to terminate.

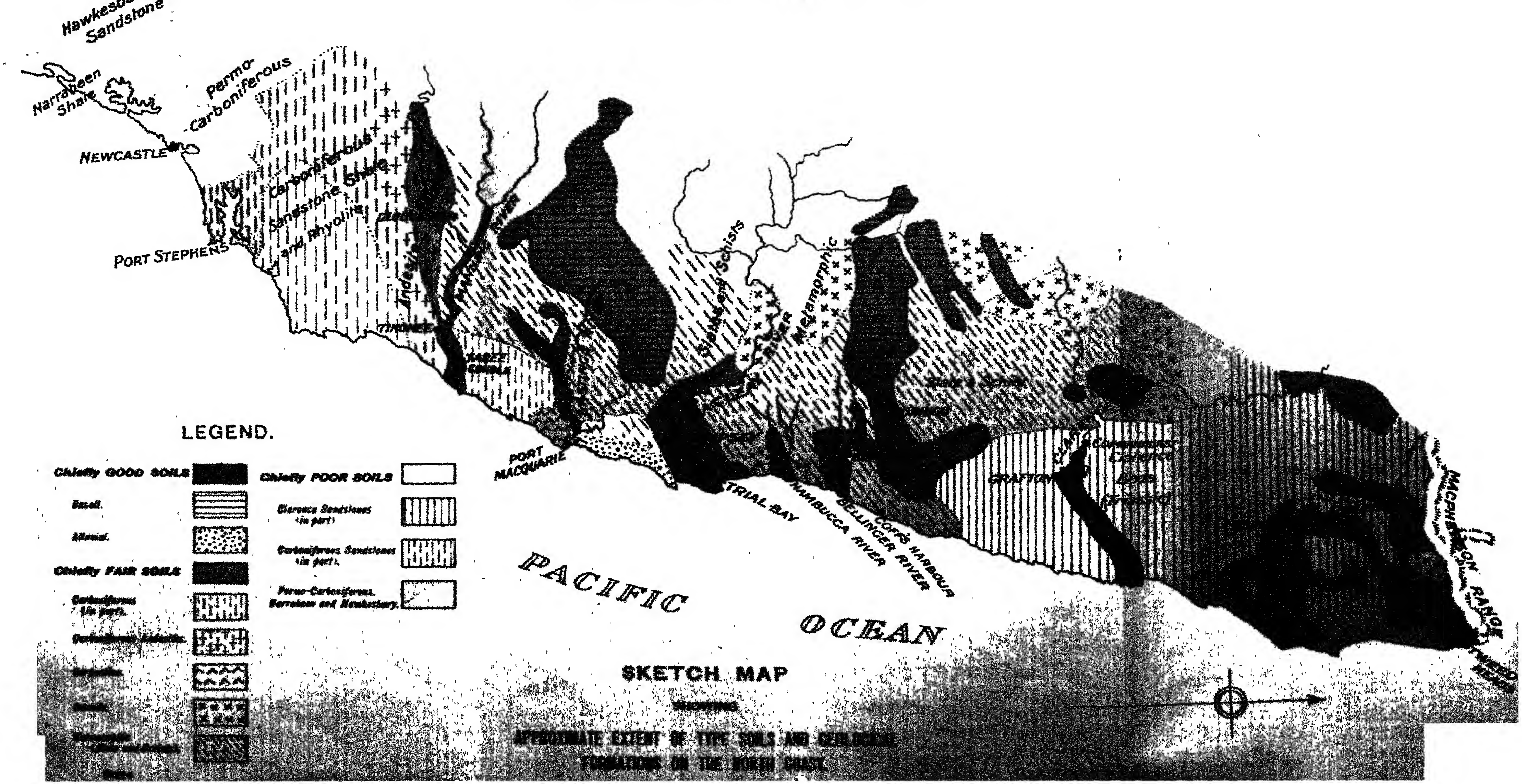
Liming of North Coast Soils.

All soils which are poor in lime do not require liming to the same degree. On the North Coast there are many scrub soils which belong to the class of leached soils or leached humus soils, and exhibit a remarkable deficiency in lime as far as their chemical analysis determines. Yet these soils are extremely fertile, and as far as one can gather at present, liming does not essentially improve them. Such soils occur on the North Coast ranges and tablelands, *e.g.*, Comboyne Range, Dorrigo, Macpherson Range, &c. They usually overlie geological formations like basalt, dolerite, &c., which are well provided with lime, so that in all probability the soil waters contain sufficient lime as well as other plant food for the need of crops. The luxuriant growth of vegetation on these rich soils produces a great amount of humus by its decay; and by the agency of the humic acids and carbonic acid given off by decaying vegetable matter, all excess of plant food is leached away.

The scrub soils therefore do not as a rule require lime. Neither do the alluvial soils, though some of these are of a very heavy clayey nature, and lime may aid to bring them into a fair mechanical condition. The need for lime in such cases must be determined by the agriculturist himself by field experiment.

Slate, shale, granite, and sandstone soils may or may not exhibit chemically a deficiency in lime. Of these, slate and shale soils are often of a pulverulent, finely-divided texture, which makes them very clayey and sticky when wet, and when they dry they become caked. After they are broken up it is extremely difficult to get them to take up moisture. Soils exhibiting these properties usually benefit from liming, even if the amount of lime present seems satisfactory to the chemist. The addition of lime coagulates the particles and creates a nice crumbly texture.

Some sandstone and granite soils derived from very felspathic rocks also exhibit these characters and benefit from liming, even if a satisfactory amount is already present.



SKETCH MAP

APPROXIMATE EXTENT OF TYPE SOILS AND GEOLOGICAL FORMATIONS ON THE NORTH COAST.

TABLE X.—Volcanic Soil, Northern Rivers.

Locality.	Colour.	Reaction.	Water Capacity.	Absolute Weight per acre.	Capillarity.	Clay	Moisture.	Volatile.	Nitrogen.	Lime.	Potash.	Phosphoric Acid	Remarks.
Tweed Heads, type soil ..	Red ..	Very strongly acid.	per cent 64 High.	lb. 1,400,000	inches. 5¾ Good.	per cent 85 Clay.	per cent. 8·40	per cent. 18·99	per cent ·392 Good.	per cent ·162 Satisfactory.	per cent. ·049 Bad.	per cent. ·102 Satisfactory.	Subsoil stony.
Average of 68 North Coast basaltic soils.	....	....	..	....	...	...	6·56	15·07	·240 Good	·167 Satisfactory.	·087 Fair.	·199 Satisfactory.	... .
Average of 22 red and chocolate Dorrigo soils.	....	....	....	....	....	....	6·73	17·92	·286 Good.	·042* Deficient.	·098 Fair.	·175 Satisfactory.	* Counting in four calcareous soils, the average rises to ·179 per cent.
Average of yellow Dorrigo soils.	....	....	...	....	..	...	8·76	15·55	·272 Good.	·040 Deficient.	·119 Satisfactory.	·152 Satisfactory.	....
Grafton Experiment Farm	Red ..	Strongly acid.	42 Fair.	1,425,000	10½ Excellent	55·7 Loam	2·48	8·07	·168 Good.	096 Deficient	·029 Bad	·116 Satisfactory.	....

Sandstone, granite, shale and slate soils which are extremely poor in lime, and not too rich in humus and organic matter, will also benefit from liming through the addition of the chemical in which they are specially deficient.

Humus soils (leached scrub soils) which are in good mechanical condition, but still deficient in lime and having a subjacent geological formation poor in lime, will probably benefit more by the addition of powdered limestone than by the addition of slaked lime.

The North Coast soils which need lime may therefore be stated to be:—

(1) *Sandstone* soils.—(a) Those derived from the felspathic or tuffy sandstones of the Carboniferous and Permo-Carboniferous formations. These need liming both because of a chemical deficiency in lime and because of their stiff mechanical condition. Liming should be at the rate of from 5 cwt. to 1 ton of freshly slaked lime per acre. The sandstone soils in the Gloucester and Stroud districts are largely of this type.

(b) Those derived from the very siliceous sandstones of the Clarence River beds, and the Permo-Carboniferous rocks like those of Raymond Terrace, which are chemically very poor in lime. Liming should be at the rate of 10 cwt. per acre.

(2) Any *Granite* soils which exhibit chemical or mechanical characters indicating need of lime. Those derived from acid felspathic (aplitic) granites (red granites) especially conform to this type. Granites with abundant dark minerals seldom need lime.

(3) *Slate* and *Schist* soils of the peculiar characters mentioned. Such slate soils occur abundantly between the Manning and Clarence Rivers.

(4) *Shale* soils of similar character. Shales are not abundant in the North Coast district, but there are some fairly large shale areas, both in the Carboniferous region south of the Manning and in the Clarence sandstone area in the north.

The slate, schist, and shale soils would have to be limed at the rate of from 5 cwt. to 1 ton per acre according to their nature. The amount to be used should be determined experimentally by the agriculturist himself.

Explanation of Map.

It was absolutely impossible in the time at my disposal to get over the area shown in the map, but typical soils of the geological formations represented in the area were collected and analysed. It is assumed therefore that each geological formation is covered essentially with its type soil, and the geological map of the Mines Department is used as the basis of a rough soil map.

It must not be supposed that all the soils within a yellow area are uniformly bad, or within a brown area uniformly good. There are occasional poor stretches in the good areas, and frequent good alluvial and volcanic stretches in the bad areas.

The colouring can only be taken to roughly indicate the average for the district.

Turkeys: In Health and Disease.

[Continued from page 989.]

G. BRADSHAW AND A. L. WYNDHAM.

DISEASES OF TURKEYS.

TURKEYS are prone to all the complaints which attack fowls, and the additional one of Blackhead, an importation from America, and the one of all which is most difficult to cure.

As with fowls, roup is the most common disease of all; but through the wider range of turkeys, smaller flocks, and their being kept in a less confined state than fowls, the disease is not so prevalent, the recorded instances of attacks being largely amongst flocks where an attempt has been made to keep them in comparative confinement.

Roup.

The chief causes of this disease are damp, cold, insanitary conditions, and contagion. Turkeys frequently get it through contact with the fowls, and once a single specimen is infected the disease becomes epidemic, the whole brood of youngsters thus being often lost.

Roup can be readily separated into three varieties—Simple catarrh or cold; catarrhal roup; and diphtheritic roup. The first of these is not contagious, and readily succumbs to treatment; but the second and third are contagious.

A contagious disease is one dependent for its existence on some specific organism, and catarrh does not come under this catalogue, it being simply a cold, the evidences or symptoms being a clear, watery discharge from the mouth and nostrils. It is easily amenable to treatment. The turkeys, whether young or old, should be removed to a warm place, free from draught, and the head, face, and eyes bathed daily with a warm solution of boracic acid. Sometimes diarrhœa accompanies the colds; 3 to 7 drops of chlorodyne will cure this.

The earliest symptoms of contagious catarrhal roup are similar to those of the above, except that the watery discharge becomes thicker, and the eyes and nostrils often become glued up by the hardening of the discharge. If not treated, the discharge becomes of a solid, cheesy nature in the nostrils and cavities of the eyes. The membrane of these cavities and the nostrils and palate become inflamed, and the cheesy matter grows to such an extent that it often crushes the eyeball right out of its socket. It is nothing unusual to see an occasional turkey in the Sydney market with but one eye, the other having been destroyed in the way mentioned.

Treatment consists in isolating all infected birds, and bathing the face and nostrils, as in catarrh. All the cheesy matter must be removed from the nostrils and eyes, and the parts washed or syringed with warm water, containing some Condy's Fluid. The throat must be examined, and if there be any cheesy growth it must be removed, and the place painted with a 2 per cent. solution of carbolic acid.

Diphtheritic roup is a contagious disease. The most obvious difference between diphtheritic roup and catarrhal roup is that in the former the lining mucous membranes of the mouth and nostrils become covered with a creamy-coloured false membrane, which is so closely united to the mucous membrane that the latter bleeds if the false growth is removed.

The treatment of diphtheritic roup is unsatisfactory, and unless the birds are very valuable it is better to destroy them than to attempt a prolonged doctoring. As a preventive of contagion, it is a good plan to place a small piece of camphor in the turkeys' drinking water. Diet throughout the treatment should consist of warm milk and bread.

Roup in turkeys is exactly similar to that in fowls; and readers are referred to the more extended notes on the disease published in the *Gazette* for January, 1907, and embodied in Farmers' Bulletin, No. 15—"Diseases of Fowls."

Farmers, and others who breed turkeys, should not attempt cures in severe cases, for at best they are but patched up, and will never make good breeders.

Internal Parasites.

The parasites of turkeys are largely a replica of what are found on and in fowls, and consist of lice, mites, fleas, worms, &c. The internal ones are termed worms, of which there are many sorts. The majority of them infest turkeys and fowls, some turkeys only, while a prominent American authority particularises one or two sorts which are found in fowls, ducks, geese, and turkeys.

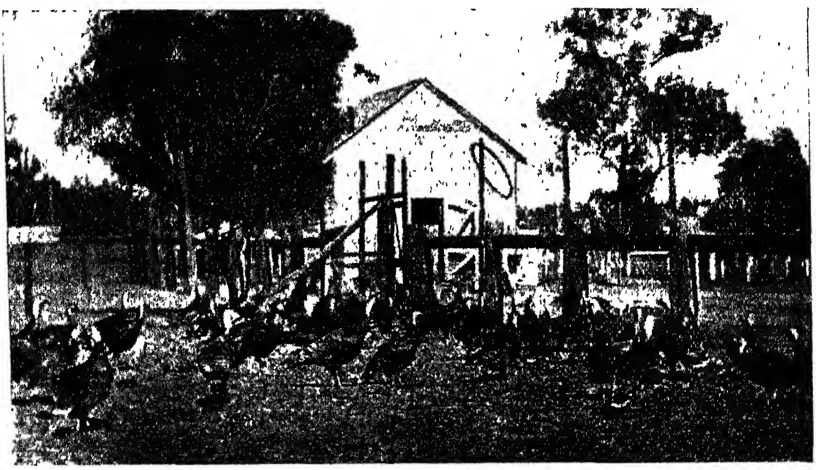
Parasitic worms infest many turkeys whose owners do not all suspect their presence. Worms, when present in troublesome numbers, interfere seriously with the health of their host. Considering the condition produced by them as a disease, it is found that the symptoms are not very marked until a rather acute stage has been reached. The actual presence of worms can only be determined by finding them in the turkey's droppings, or by *post-mortem* examination. When one or two fowls or turkeys become infested, the trouble soon spreads to the whole flock. They are passed from one bird to another. The small worms or eggs come from the infested ones in the droppings, and are eaten by the others.

When their presence is discovered, it is best to begin treatment with a dose of castor-oil to each bird. The morning following this, each bird should be given from 15 to 20 drops of turpentine in a teaspoonful of salad-oil, and two hours afterwards a breakfast of scalded bran only, into which half a teaspoonful of Epsom salts for each bird has been mixed. If this is repeated every two days for a week, the worms will be dislodged.

Other remedies are a 4-grain pill of santonine, followed by half a teaspoonful of castor oil; or 8 to 10 drops of male-fern in a teaspoonful of sweet or salad-oil. The above is for adults; a quarter of the quantity will suffice for turkey chicks. The turpentine and other remedies should always be given on an empty stomach.

External Parasites.

However numerous the varieties of internal parasites of feathered stock, the external ones fall little short of them in numbers. Some of them, such as lice, live permanently on their hosts, while others, such as fleas, some mites and ticks, go to and fro. Some live among the barbs of the feathers; others with their heads against the skin, and their bodies erect. The external parasites sometimes cause the turkey hen to abandon her nest, and hatching failures are often due to their presence. All of the external vermin breed



Seventy-two Turkey Hens on hand at Wagga Experiment Farm, June, 1910; before yearly sales.

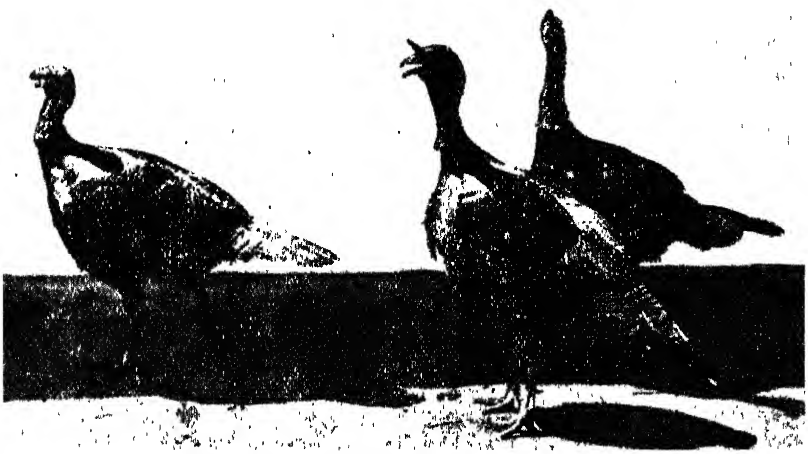
rapidly, while their habits are such that, although largely due to dirt, they quickly spread from dirty birds to clean ones, and thus often invade yards celebrated for cleanliness

Lice are not blood-suckers, but bite and chew the feathers, living on them and the epidermis of the skin. Mites and ticks are the most dangerous. These do not live on the birds, but visit them at night, and suck their blood.

Fleas are more troublesome to fowls than to turkeys, and are usually found in dirty, close, insanitary buildings. They lay their eggs in the dust and crevices of the wall, and entomologists tell us they breed all the year round.

When it has become known that there is an infestation, the first thing to do is to make a complete clearance of every internal fitting of the house—perches, boxes, and everything else should be removed out into the poultry-yard and given a thorough painting with kerosene, and this repeated the second day. The inside walls of the house should then be given a good

brushing down with an old kitchen broom, then a thorough painting with kerosene, to be followed with a coating of whitewash, to which has been added, say, 1 pint of crude carbolic to each gallon of the wash. Should the poultry-houses be extensive, and kerosene be considered too expensive, an emulsion of such will be effective, viz., 1 gallon of kerosene, 1 of water, and 1 lb. of soap boiled together for about half an hour. One authority recommends for a wash for the house and fittings a decoction made by boiling 4 ounces of tobacco in a gallon of water. A generous application of crude carbolic is another excellent remedy. A cheap quality of this can be procured, and a good way to apply it is with a garden syringe, which will drive it into every crevice of the house, and what runs down the walls on to the floor of the house will be equally useful there. A crude petroleum can also be had cheaply, and is as effective as the finest kerosene.



Gobblers imported from America, at Wagga Experiment Farm.

Lewis Wright says on this subject :—

The red mite lives mainly in the crevices of houses and roosts, coming out at night to feed on the birds. It is naturally white, but becomes red when fed with blood. The eggs are seen in crevices, especially where ends of perches rest, as white dust. All should be removable, and the surfaces of such places washed daily with kerosene. This and frequent carbolic lime-washing and removal of manure will be effectual. The following is a cheap and easy method of preparing carbolic wash :—Boil ½ lb. of soft soap in 3 quarts of water, and while still boiling hot, agitate with it a quart of the crude carbolic acid. Keep this corked and labelled "Poison," and when a wash is wanted mix a pint with a bucket of water, and syringe with it freely. Another wash, quite as good, is made by shaving up 1 lb. of yellow soap in 3 pints of boiling water, keeping hot till all dissolved. Then remove from the fire to avoid danger, add 3 pints of kerosene and a gill of crude carbolic acid, and agitate briskly for fifteen minutes, which will make a creamy emulsion. When well emulsified add 12 quarts of weak soap solution and mix well. This is to be sprayed freely over the interior.

Lice are of less consequence, but dangerous withal. A vermin-infested bird will not lay well, and will not hatch well, frequently leaving the nest before the eggs are due; and what is nearly as bad, should she hatch them,

lice are immediately transmitted to the chickens, many of them dying from the effects. Lice, however, are more easily exterminated than the mites, a few dustings with one of the many insect powders being effective. Pyrethrum powder is the best, and it is said this forms the basis of many of the insecticides. Tobacco dust, which can be had in Sydney for as low as 3d. per pound, is also most effective, and a handful of this placed in the setting hen's nest, and another handful added when within a week of bringing out her chicks, will keep her free from these irritating pests. Another good dusting powder is 1 oz. of 90 per cent. carbolic acid added to a peck of fresh air-slacked lime, and stirred thoroughly. In using dusting powders, the simplest way is to spread out a newspaper; hold the hen by her legs, with the body and head hanging down; the powder can then be worked into the feathers down to the skin. The struggling of the hen will assist in working in the powder, and what falls on to the paper can be used again. Indeed, to be effectual, there should be two or three dustings at intervals of a week.

Blackhead.

Generally speaking, the diseases of turkeys are similar to those in fowls, with, perhaps, the exception of one, which originated in America some years ago, the name given to it being Blackhead, due to the fact that, at a certain stage of its development, the turkey's head turns quite black. It is scientifically named *Infectious Entro-hepatitis.*

It is still a matter of dispute as to the exact date when blackhead in turkeys was first noticed, but, by 1894, its ravages amongst the large turkey flocks of Rhode Island and adjacent States was such that several of the experimental colleges undertook investigations with the object of determining its cause, cure, &c. In 1895, Dr. Theobald Smith, in his investigation concerning the infectious diseases of poultry for the United States Department of Agriculture, reported a disease in turkeys caused by protozoa, a low form of microscopic life, and stated that in Rhode Island it was known as Blackhead—a synonym which, though unsatisfactory, is still retained—and that it had spread to an alarming extent over many States.

Dr. Smith ascertained first that the disease is especially characterised by great sores in the cæca—the blind tubes near the end of the intestines—and in the liver. In explaining the character of the disease, he compared it to amebic dysentery in the human subject, a disease which also attacks the large intestine and liver.

The parasites, while microscopic in size, are at least three or four times larger than the red-blood corpuscles, but they are small enough to float in the blood capillaries from the cæcum to the liver, where they seem to be stopped from going further. Briefly, the ameba is a parasite capable of living within the tissues of the turkey—its host. It can, therefore, eat, grow, and reproduce itself in large numbers, thereby causing irritations, destruction of the tissues, and nearly always death of the invaded turkeys; and it has practically destroyed the turkey industry of New England, and is rapidly depleting the flocks of the Western States.

Mr. Cooper Curtice, of the Rhode Island Experiment Station, in a recent bulletin, gives the results of hundreds of experiments, costing many thousands of dollars, and extending over a great number of years, at that station. The publication is extensively quoted in Farmers' Bulletin, No. 15—"Diseases of Fowls,"—pages 94, &c., and may be summarised as follows:—

The eggs do not carry the protozoon or organism which is the direct cause of blackhead or entro-hepatitis of turkeys.

Poults or adults become affected with the disease at some period after they become exposed to contaminated surroundings. This period is usually within four weeks, and the poults most commonly die in from twelve to twenty-four days after exposure, although some may escape for months.

The change of colour of the head from red to black is not always observed in either young or old turkeys, as in acute cases they die before the change of colour. Refusal to eat, and standing apart, are late symptoms. Diarrhœa is usually present. "In many of the older poults, the droppings will be liquid, and stained orange-yellow; this is the most characteristic symptom of all. Sometimes there are blackened clots in the droppings, indicating slight hemorrhages. There is, however, no surer means of diagnosis than the presence of the large sores made in the cæcal walls, and in the substance of the liver, and the finding of parasites. The former may be seen by anyone; the recognition of the latter requires expert knowledge of microscopic work."

Fowls are not subject to the disease, but are hosts of the causative parasites, and, together with the adult turkeys, spread them broadcast through the droppings.

The protozoa seem to be easily killed by drying, and dry sandy soils would, therefore, seem to be preferable for turkey-raising.

No breed of turkeys thus far tested is immune to the blackhead disease, for all varieties, at all ages, so far as tried, have died of it.

The older turkeys apparently resist the disease better than those which are very young, since about 20 per cent. of the former have been found to die in the course of the year, and about 90 per cent. of the latter.

No medicinal remedy which is efficacious and economical is yet known. No antitoxin or vaccine is practicable for such a disease; these are generally prepared for diseases of another character, and for animals of greater value.

The experiments show that turkeys should be reared away from the house, and be kept from all fields where ordinary fowls forage.

Concerning the disease beyond the country of its origination, Mr. E. Brown, F.L.S., Assistant Director of Agricultural College, Reading, England, says:—

So far as I am aware, this disease is unknown in Europe—certainly in Britain; and in order to protect our birds from disease—for the result could not fail to be disastrous were it introduced—I submit that it is essential for steps to be taken to prevent the importation of affected birds. The only possible way is to absolutely prohibit the importation of breeding turkeys from Canada and the United States until a clean bill of health can be shown. I am reluctant to recommend this course, but there does not appear to be any other method available. Quarantine would not afford any real protection.

Coming to Australia, unfortunately the disease is here, there being grave records of its ravages. Mr. McKeown, Manager of the Wagga Farm, who has had much experience in turkey-raising, says:—

It is now several years since the disease was first noticed in this country; it no doubt, came with some of the importations of turkeys from America to this and a neighbouring State, and it has spread to an alarming extent.

Indeed, in some districts, noted one time for the thousands of gobblers sent each year to Sydney, the scourge is such that breeding is not now even attempted; this, the fox-pest, and the rabbit poison-cart being responsible for a possible turkey diminution within the past ten years of about 50 per cent. This shortage is responsible for the high price now obtaining, but which is poor consolation to those who have lost their entire stock, and through contaminated ground, are inhibited from a further early attempt at this one time remunerative industry. Fortunately for the industry, recent reports indicate that the virulence of the disease is abating, and it is confidently hoped that it will soon be a thing of the past.

On farms where the disease has existed, the liberal use of slaked lime in the yards previously occupied by the diseased turkeys is recommended. The following is a serviceable disinfectant:—Crude carbolic acid, one half-gallon; crude sulphuric acid, one half-gallon. These two substances should be mixed in tubs or glass vessels. The sulphuric acid is very slowly added to the carbolic acid. During the mixing a large amount of heat is developed. The disinfecting power of the mixture is heightened if the amount of heat is kept down, by placing the tub or glass vessel containing the carbolic acid in cold water while the sulphuric acid is being added. The resulting mixture is added to water in the ratio of 1 to 20. One gallon of mixed acids will thus furnish 21 gallons of a strong disinfecting solution, having a slightly milky appearance. It is quite corrosive, and care should be taken to protect the eyes from accidental splashing.

The houses, roosts, yards, and other places over which the turkeys have had access, should receive one or two liberal douchings with the above, and rearing should not be again attempted till six months after the last dressing; and care should be exercised that new stock should come from unaffected yards.

Abscess or Bumble-foot.

This is more common in turkeys than in fowls, and is due largely to their habit of roosting as high as possible. The trouble is more prevalent in dry districts where the ground is hard.

The preventive measures used at Wagga are to bed the yards with straw where the birds alight from the perch, and in the case of the very heavy birds, to give them no perch; and also to bed the sleeping-ground. When cases occurred, one or two paintings with iodine usually effected a cure.

Liver Disease.

This trouble was prevalent at Wagga Farm some three years ago, but the Manager refused to dispose of a bird while there was a trace of the disease.

Preventive measures in practice are to sweep up all droppings under the roost at least twice a week; to spray the roosts at least once a month with a strong solution of phenol; to allow the turkeys out of their yards from sunrise to dark; provision of wood charcoal constantly before the birds; medicating the drinking water with Epsom salts, and a small amount of permanganate of potash: and to avoid overfeeding, the use of rich oil food, hot food, or spices; but to feed in troughs or on boards.

The cases of disease mostly occurred in hens after having completed setting, which would lead one to believe that spraying the nest two or three times with a 2 per cent. solution of disinfectant during hatching might be preventive. Other cases, indicating the disease, have occurred in poults at early stages, and would point to hereditary causes, or contact with the hen, the first indication being the death of the subject.

Successful treatment has been with adult birds in the early stages of the disease. The dose given individually was ¼ ounce of Epsom salts, and two or three grains permanganate of potash in a tablespoonful of water. As a preventive, 1 ounce Epsom salts to every 4 gallons of drinking water was found beneficial. Sulphate of iron and lime were also used in the water. Individual doses of 4 drops of chlorodyne in a teaspoonful of salad-oil have also been successful in the first stage of the disease.

Other Diseases.

Ovarian troubles are almost unknown at the Farm, only one death occurring in four years.

Bronchitis was only experienced in two cases, one being cured by a tablespoonful of raw linseed oil; the other by a tablespoonful of salad-oil and 4 drops of chlorodyne.

Occasional cases of colds have been experienced, but such usually surrendered to a certain roup cure.

Scaly legs have been treated in a few cases, but are very rare. When the roosting places are kept clean, one or two applications of kerosene to the affected legs are sufficient.

As the turkeys have free range, there is no occasion to supply them with a dust bath; consequently, there was no experience of vermin trouble.

During the past year a peculiar ailment occurred among the young poults. Their toes turned up and became shrivelled, some of them breaking off. A cure was effected by 4 drachms of powdered sulphate of iron and equal parts of fine wood charcoal to every quart of pollard and bran. Unslaked lime was added to the drinking water.

THE END.

Our Experiment Farms.

J. E. O'GRADY.

GLEN INNES.

Manager—R. H. Gennys. *Experimentalist*—H. Bartlett.
Orchardist—W. Le Gay Brereton. *Farm Foreman*—B. A. Cooney.

SHORTLY before reaching Glen Innes, the Great Northern Line passes Ben Lomond, 4,473 feet above sea-level, the summit of the New South Wales railway system. With such an elevation, and in latitude 30 degrees south, the New England Tableland has a climate of its own, differing in important particulars from that of any other district in the State. Add to this that the soil is of an entirely distinct type, and it will be readily understood that the most profitable utilisation of the natural resources of the Tableland requires the adoption of methods which elsewhere would probably lead to financial loss.

Landholders of the district devote their attention to mixed farming, on English lines. Dairying is carried on to a considerable extent. English breeds of sheep are found profitable, whilst the Merino deteriorates in size of frame and length of wool; but the quality is excellent, these Merino wools being invariably amongst the highest priced. Oats thrive excellently on the flats; but the varieties of wheat which yield so well in the warmer and drier districts are found practically worthless in milling quality when grown here; whilst, on the other hand, a few of the stronger varieties of Farrer wheats and Haynes' Blue-stem show considerable promise. English fruits will probably soon beautify and enhance the value of large sections of the country, besides sprinkling the landscape with those picturesque homesteads, which usually accompany the planting of orchards; but on the extreme highlands the risk from late frosts is very great.

The chief difficulties which beset the farmers are the heavy, retentive nature of the soil, the short growing season, and the frosts. The black soils on the flats return excellent yields of oats and early-maturing maize, but are so retentive of moisture that cultivation is often exceedingly difficult. Frosts dry up the native pastures in the winter, and the general introduction of grasses and clovers suited to the winter climate is receiving attention. In these and other directions the Department is endeavouring to assist progress in the district by experiment and demonstration.

The Farm.

The Glen Innes Experiment Farm comprises an area of 1,050 acres, 4½ miles from Glen Innes, at an elevation of 3,600 feet above sea-level. It was established in August, 1902, and Mr. R. H. Gennys, the present Manager, has controlled the operations from the start. The site was virgin land,

heavily timbered with white gum and peppermint, chiefly the former. These are both difficult timbers to burn, and moreover the white gum is a useless farm timber, except for temporary fencing. The immediate locality is poorly supplied in this respect. Some of the fencing timber around the orchard had to be carted 30 miles.

The whole area has been ringbarked and scrubbed, except that liberal provision has been left for shade. Some of the timber suckers rather badly, and portions of the Farm will soon need to be gone through again.

So far, 180 acres have been cultivated, including the area sown with grasses; but an additional 106 acres have lately been cleared and ploughed. An ample water supply is obtained from two large tanks, and some smaller dams in the gullies. The boundary fences are all seven-wires, with 10-feet panels, and two battens between each pair of posts. The subdivisions are all wire netted, so as to avoid danger of the sheep becoming mixed, as well as to prevent hares interfering with the experiment paddocks.

Farm Buildings.

The erection of a complete set of farm buildings is now being proceeded with, and the Department is endeavouring to make the Farm an object lesson in this regard. The buildings are not on the lavish scale which many successful farmers and pastoralists in the district are in a position to construct; neither are they of the poor description which is unfortunately too common in many parts of the State. They are substantial, neat, and reasonably inexpensive, due regard being paid to the nature of the climate and the facilities available. It is hoped that many farmers on the Tableland will receive assistance by way of suggestion from these buildings. Unfortunately, the making of concrete is rendered expensive by the fact that sand has to be carted 16 miles, and costs 22s. a load. There is an abundance of excellent basalt metal at hand; but this necessitates a large proportion of sand, ½ yard of sand to 1½ bags of cement being used. It is feared that the price of sand will preclude the general use of concrete in the district.

The Manager's cottage, of which a photograph is given, is prettily situated on elevated ground, overlooking the area devoted to field trials with grasses and the recently cleared paddock which it is proposed to utilise for experiment work. A site on this rise has also been chosen for the students' quarters, plans of which have been approved. Accommodation will be provided for twenty students, including some from England under the apprentice system.

The stables, coach-house, and barn (the latter can also be used as a shearing shed, and is fitted up with shearing machines) are all under one roof. The stall floors are paved with wood-blocking. All the other floors are of cement, and all the buildings are on concrete foundations. A chaff silo is provided, which is self-acting. It is never necessary to go inside and shovel out the feed; all that is needed is to lift the small door. The chaff is elevated into the silo direct from the cutter. The corn and oat bins are also self-acting. The walls of the stables are of weatherboard, and the building is excellently lighted from the roof.

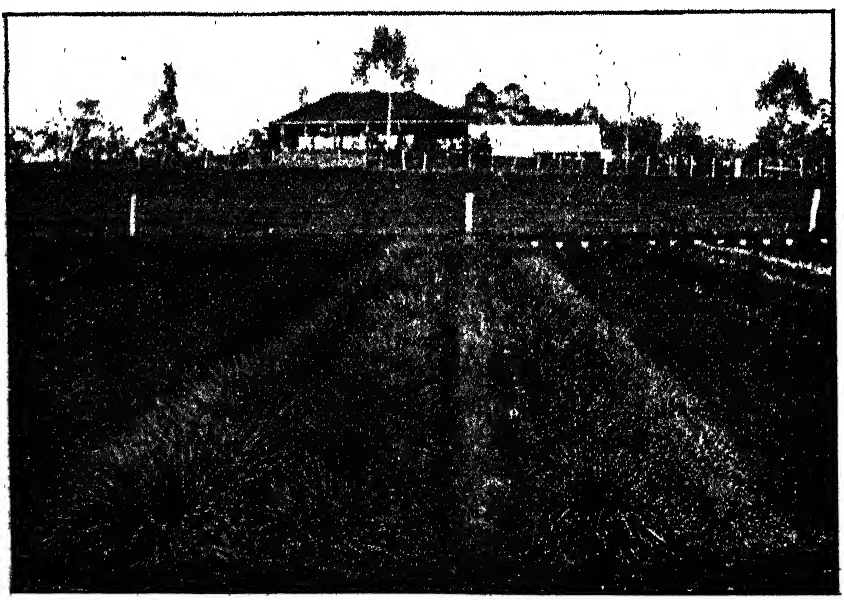
Other buildings include implement shed and foremen's store-room, under one roof; fruit-packing house and storeroom combined; boiler-house, dairy, hay-shed, &c. The piggeries are quite up to date, having brick and cement floors Six sties are provided for boars, and six for sows. Between the two sections is a commodious feed room.

A neat set of self-acting cow-bails has just been completed, as well as a small dairy. The latter is built of hardwood studs, covered with patent steel lathing. The lathing is coated with hair mortar gauged with cement, and then finished off with a coating of cement about 2 in 1. The illustration shows the dairy in course of construction.

In addition to the students' quarters, it is proposed to presently erect cottages for the foreman, orchardist, and herdsman. The orchardist's cottage will be built on the site of the present small public school, the Public Instruction Department intending to provide a school in another position.

Experiments with Grasses.

The native grasses of the New England Tableland, while providing excellent fodder in the warm weather, are decidedly unsatisfactory in the winter, as they cannot withstand the heavy frosts. Travelling through the district at the end of winter, one could but feel astonished that the stock should live through on the frosted, innutritious pasture everywhere prevalent except where hardier grasses and clovers have been introduced. Not only are the sheep kept poor by this want of provision in Nature, but the consequent weakening of their winter condition predisposes them to the



Grasses from Roots, Experiment Plots, Glen Innes Experiment Farm.

Clovers, Experiment Plots, Glen Innes Experiment Farm.

attacks of lung and stomach worms, from which considerable trouble and loss have been sustained in the past.

Mr. Gennys has planted a number of introduced grasses in rows for comparison, particularly in regard to their power of withstanding frost. Tests of these grasses have been made, grown both from seed and from roots. The plots have now been down more than twelve months, and interim results may be gathered.

At present, far and away the most promising is the grass known as *Phalaris commutata.* It is a prolific grower, stools well, and makes more growth during the winter than any other grass tried. It is not yet definitely known how it will withstand stocking in the field. A little plot has been planted in another paddock and fed down three or four times during the season. It has stood this test very well, but it was not subjected to the treading that it would receive in the field. An actual field test is to be made, and if the grass is found to be capable of resisting the trampling of stock, it should be as great a boon to the Tableland as *Paspalum dilatatum* has been to the North Coast. Meanwhile, a number of progressive pastoralists are also testing the grass.

Another grass, known for the present as *Phalaris cœrulesc·ns,* is growing alongside. Botanically there is little difference between the two, the Index Kewensis giving them as forms of the one variety, *Phalaris bulbosa.* But in practice the difference is striking, and intending growers should make sure that they obtain seed of the true *Phalaris commutata.* The other grass does not grow so tall, does not stool so well, and there are indications that it may not prove perennial. In these plots, *Phalaris commutata* would appear to provide about eight times as much fodder as the grass known as *Phalaris cœrulescens.*

The following are a few brief notes on the other grasses which are being tested:—

PRAIRIE GRASS (*Bromus unioloides*).—A fine winter grass, but will not stand heavy stocking. If it is put into cultivation paddocks it will beat out almost any grass, but it must not be eaten closely.

PERENNIAL RYE GRASS (*Lolium perenne*).—This is a standard grass, and is being used as a check. It gives good results in moist situations, but it is unsatisfactory in dry weather. Still it stands feeding well, and is one of the best grasses on the Tableland. It should be eaten down, and not allowed to seed for two years after being put in.

ITALIAN RYE GRASS (*Lolium italicum*).—A good grass, but only a biennial. It makes good hay. It should not be sown alone, but may be sown with Perennial Rye. For two years it will be better than the Perennial Rye, but will then die out and give place to the latter.

Schedonorus Hookerianus.—This is a native grass, obtained from the Monaro district. It is a bad germinator, but grows well from roots. It is very good in the winter, but in feeding value is not equal to *Phalaris commutata*.

COCKSFOOT (*Dactylis glomerata*).—This grass is very hardy, but in feeding value is about the worst of the introduced grasses. It also requires to be eaten down; otherwise it grows coarse and woody.

TEXAS BLUE GRASS (*Poa arachnifera*).—Very hardy, and stands the winter very well, but in feeding value it is not equal to Kentucky Blue.

KENTUCKY BLUE (*Poa pratensis*).—Propagates itself somewhat like Couch-grass, but keeps more underground. This is probably the best lawn grass for the district, planted with a little white clover, but it should never be sown on land which it is proposed to cultivate afterwards. It is a bad germinator, but once it starts it thrives well.

TIMOTHY GRASS (*Phleum pratense*).—A useful grass, of good fodder value, and a good hay grass. It thrives fairly well in the district.

Bromus pratensis.—Resists frost fairly well, and is a nice-looking grass. It is worth further trial.

Paspalum dilatatum.—This grass, which gives such excellent results on the North Coast, is quite unfitted for the severe winters of the Tableland, and should perhaps be kept out of the pastures there, as in spite of its magnificent growth in summer, it might choke out grasses which yield good winter fodder.

ENGLISH BLUE GRASS (*Poa compressa*).—This grass was supplied to the Manager by a New England grazier for identification. It seems to suit the district, and should be a good sheep grass in pastures. Like Kentucky Blue, it should not be planted in cultivated land, as it propagates itself underground. The stalk is very flat, as if it were compressed. Mr. Gennys has great hopes of this grass.

These are the most promising varieties yet tried, others in the plots not giving as much promise. Of the native grasses tried, *Andropogon intermedius*

and *Andropogon sericeus* give good results in the summer, but the frost kills practically all growth in the winter. *Eriochloa annulata* (an annual only) is a fair spring and summer grass. Several others failed to germinate.

Clovers.

Similar tests of varieties of clover have been made in the same paddock, and, as would naturally be expected, several kinds have proved eminently suitable for the New England climate. Perennial Red Clover (*Trifolium pratense perenne*) is the one which should be grown, but it is not certain that pure seed of this variety is obtainable in the State. Red Clover (*Trifolium pratense*) propagates itself from seed, as is clearly proved by patches of it springing up amongst the grass on various parts of the Farm.

Other clovers and medicks thrive in this cold climate, especially Black Medick (*Medicago lupulina*), a trefoil whose seed-pods do not adhere to wool ; and hairy vetches do very well. In addition to mixing these various legumes with the pasture grasses, the Department has been urging farmers to plant them with cereal crops, as they add nitrogen to the soil and benefit the wheat and oat crops, as well as providing excellent pasture. There seems to be no reason why clovers should not take the place of the weeds which almost invariably accompany the growth of cereals in moist districts. The seed may be sown with the wheat, or later when the young wheat is being harrowed. Clover seed should not be covered deeply. Harrow, then sow the clover and lightly cover ; but if the ground be rough, just leave the seed alone without covering.

Feeding Trials of Grasses and Clovers.

In front of the Manager's cottage there is a paddock of about 16 acres, which has been devoted to field trials of the grasses which promised well. About 3 acres were sown with each grass, and in each case red clover seed was planted with the grass, in the proportion of 20 lb. grass and 10 lb. clover seed per acre. The paddock has been stocked with sheep, so that the relative values of the grasses may be seen under actual field conditions.

An interesting and valuable result was obtained with this clover. Portion of it was mowed closely, and not allowed to seed. This portion has nearly all gone out. Another section was not mowed, and stock were kept off it. The result was that it set seed, which dropped to the ground and germinated without difficulty. As there were then no bumble-bees in the locality, this shows that there is some other fertilising agent present. Whatever it may be, it is certain that this clover (apparently *Trifolium pratense*, not the perennial variety) will reproduce itself from seed on the Tableland. Mr. Gennys had the plot harrowed while the seed was on the ground, to distribute it evenly, and it is now a finer and more even crop than could have been obtained by artificial sowing. There are about 3 acres of this self-sown clover.

These grasses have been down five years now. The land first grew a crop of wheat, and then the grasses were sown. They have always been heavily stocked, except during the two months when the clover was allowed to seed.

PRAIRIE GRASS had been sown with the clover which went to seed, but the sheep soon ate it out. One has to search for a plant of the Prairie Grass now.

KENTUCKY BLUE GRASS, though such a poor germinator, has done remarkably well on the feeding ground. It has formed a mat, and is excellent sheep feed. It is increasing with heavy stocking.

TIMOTHY GRASS, on the other hand, is beginning to go out under this treatment; it is not covering the ground as well as the Kentucky Blue.

PERENNIAL RYE GRASS was originally sown with Italian Rye, the latter going out after two years. The Perennial Rye has thus had a good deal to make up. At present it is just about holding its own.

COCKSFOOT was sown on the east end of the paddock, because the prevailing wind is westerly, and thus seed will not be blown on to the other grasses. The Cocksfoot shows plenty of feed, for the simple reason that the stock leave it alone when other grasses are available This grass must be used with caution. If sown with other grasses, it will choke out most of them, with the probable exception of Kentucky Blue, which propagates itself from roots; and Cocksfoot is a very poor feeding grass, except when young. It would be most useful in a paddock carrying store stock.

The Lesson of the Plots.

This paddock has made some facts very clear about grasses on the Tableland. Besides showing, as on a blackboard, the summer and winter growth of the grasses under heavy stocking, the plots enable a practical comparison to be made of their palatability. The evidence is that sheep are partial to Prairie, Kentucky Blue, Timothy, Perennial Rye, and Cocksfoot, in descending order. The advantage of having a clover with the grass did not need a field demonstration, its twofold benefit to soil and feed being well known. But the great lesson of these plots is seen in the winter, by diverting the eye to the withered, frost-bitten native pastures outside the fence. The carrying capacity of this belt of country can be enormously increased by the introduction of grasses and clover suitable for winter feed.

The Manager advocates rotation of pastures for fattening stock. If separate paddocks were laid down with several of these grasses, hungry stock could be put on the coarser pastures first, and moved on to sweeter feed as their condition improved and their appetites became more dainty. Another advantage would be, that grasses which require heavy stocking could receive it, and more sensitive ones could be "spelled" as desired. Each grass should be sown with a clover. Moreover, a variety of grasses means a variety of seasons of prolificness, and consequently it means feed all the year round. What is wanted now, is a cheap method of getting rid of the native pastures. They give no trouble to the plough, but a simple, inexpensive method of dealing with land which it is not desired to bring under cultivation would be a boon to the district. Experiments in this direction will be carried out on the Farm.

Lucerne.

Lucerne, though a profitable crop here as nearly everywhere, has not given as good results on the Tableland as in warmer sitations. Perhaps some of the deficiency is due to the difficulty of obtaining acclimatised seed, as the climates of our main seed-producing localities are dissimilar, and so far, Mr. Gennys has met with little success in his efforts to obtain seed from the Farm crops. The trouble is, that if the crop is allowed to remain for seed it shoots again from the crown, and the seed does not ripen Algerian lucerne has shown considerable promise on the uplands. The cold black flats do not seem to be suitable for lucerne.

An interesting seeding experiment is to be seen in a paddock of 5 acres. Tests were made of seed sown in the following ways:—

4 lb. per acre drilled.
8 lb. ,, ,,
20 lb. ,, broadcast.

The plots have been down five years, and the best results have been obtained from 8 lb of drilled seed.

The Soil and its Treatment.

The soil on the Farm may be classified as light clay, brown clay, and black clay. These are fairly typical of the soils of the district, but there are some heavier black soils in the open valleys. This black clay is very tenacious in character, and difficult to deal with satisfactorily. It sticks to the implements, to the horses' feet, and to nearly everything which comes in contact with it.

The severe winters can be made to serve a useful purpose in breaking down this land. The ground may be ploughed in autumn before the frosts set in, and left in a loose, cloddy condition; the frosts will then weather it down and make it friable. At the end of August, this effect was very evident on cultivated paddocks on the Farm. The clods had mostly weathered down to loose crumbs, and where they were still intact, they were so honeycombed by frost that a light kick would break them to pieces.

Of course, where wheat is being sown, this cannot be done, but on fallowed land the object is kept in view, and the ground is left as open as possible. Cultivation to conserve moisture is not practised—the need is rather to get rid of it in this soil and climate. The roller is only used when required to break heavy clods, as otherwise it consolidates the ground and forms a hard crust.

Liming is found very beneficial on the stiff clays. Half a ton to the acre has been applied to wheat land, and a ton on the orchard. A ton of lime would benefit any of the land, but it is expensive, agricultural lime costing about 34s. a ton here; but the beneficial effect lasts for about six years, and the cost of applying half a ton works out at about 3s. per acre per annum.

Draining is also necessary to best results in many places. The paddock used for the feeding trials with grasses had to be relieved of surplus moisture by running a drain along the boundary. Under-drainage—an expensive

undertaking, only payable where intense culture is practised—has been tried on a small scale in the orchard. A mole-drain plough is to be tested on a portion of the newly cleared land.

The mouldboard plough is generally preferred, but the disc is used occasionally to vary the cultivation. Both spring-tooth and disc cultivators are used according to the condition of the ground. If it is very cloddy the disc fines it down ; if it is too fine, the spring-tooth makes it rougher. Fine clayey soil runs together after rain.

Wheat is sown in the middle of the winter. One deep ploughing is given in January or February, then later on a shallow ploughing, or perhaps only a cultivating, which is inexpensive and effective.

As a rule the crops are harrowed after they have germinated, and clover is sometimes sown at this time, broadcasted on the surface after harrowing, as explained above.

Superphosphate, drilled with the seed at the rate of about 60 lb. per acre, is found to give good results on the poorer soils.

Wheat.

Wheat is sown in June or July, preferably in June if the land is in a suitable condition. Some farmers sow later, but this is not recommended on account of danger from rust. Crops should be harvested before the end of December to avoid rust, but this is often very difficult, as there is very little growth before October.

Federation wheat is not suitable for the district, as it rusts badly, and the grain is very soft on the Tableland. Jonathan, a strong flour wheat, has done remarkably well, and trial lots, grown on the Farm, have been sent to the local miller. At first it was found too strong, and the flour had to be mixed with another sort, but the following season it was treated as a straight flour, and made excellent bread, which, with the mill products, was exhibited at the Glen Innes Show.

Greater hopes still, founded on last year's returns, are entertained with regard to Cedar, the strongest of all our wheats. It had not a sign of rust in a rusty season. What this may mean to the district will be readily understood when it is stated that samples of Cedar, grown at Cowra and analysed by Mr. F. B. Guthrie, Chemist of the Department, have shown this variety to be superior in strength, bushel-weight, and percentage of dry gluten, to the famous Manitoba No. 1 Hard. A recent analysis of a sample of Cedar grown at Glen Innes, shows that it fully maintains its strength.

Other wheats are being tried in the wheat plots under the control of Mr. Sutton, State Wheat Experimentalist, where the organised wheat experiment work of the Department is being conducted for the New England district. At one time it was thought that the district could not grow strong wheats.

Oats.

Algerian and White Tartarian are the best rust-resisters. Algerian is much the sweeter, and is more relished by stock, but White Tartarian has a

better colour, and the chaff is more marketable. Oats are sown in July or August, and the heavy black flats are suitable for this crop. Very payable yields have been obtained in the locality.

Other Crops.

Barley is not altogether a satisfactory crop. The district is not suited for malting barley on account of wet weather at harvest time. Cape is the best barley to grow for green feed.

White and Emerald Ryes do well, particularly on the poorer soils; and although the feeding value is not high, they provide an acceptable green bite in the winter.

Linseed Flax has been tried, and returns very good seed, but two out of three seasons have been partial failures for straw. The crop cannot yet be recommended.

Iowa Silvermine (white) and Pride of the North (yellow) are found to be the two earliest maturing maize varieties. Early maturity is an essential quality in maize to be grown in New England, which is not blessed with the long-growing seasons of lower localities.

Stock.

There are twenty horses on the Farm, four of them being pure-bred Clydesdales and first-class animals, bred in the district. The other horses are crosses, but they are big horses, suited to the heavy work.

Dairying has not yet been made a branch of the Farm work. Kerrys have been tried, but did not do well on the feed available in the winter, which in the natural state is quite unsuitable for dairying, especially after sheep.

There are about 700 sheep on the Farm; as many as 1,200 have been carried at times when required for feeding down rough pastures. A number of breeds have been tried; but, for the present, it is intended to confine operations chiefly to three breeds—Lincoln, Border Leicester, and Romney Marsh. A few pure-bred Cheviots are being tried. The Down breeds, of mutton type, are being abandoned until better pastures are laid down for fattening, as their fleeces are very light compared with those of the Long-wools, and they appear to be more susceptible to worms. The Romney Marsh resists fluke and foot-rot. The Border Leicester is hardy, a good wool-producer, and, for a Long-wool sheep, a good mutton producer also. The Lincoln is fairly hardy, and the best wool-producer of the British breeds.

Several breeds of pigs have been tried—Berkshire, Large Yorkshire, Large Black, Tamworth, and Poland China. Berkshires and Poland Chinas appear to be most suitable as pure-breds, but Large Yorkshires and Tamworths are useful for crossing as baconers. The Large Black is becoming unpopular, both at the factory and with the farmers.

Several crosses have been tried. One rather unusual one—Large Yorkshire on Tamworth—gave splendid baconers.

The Orchard.

As the soil and conditions at Glen Innes differed from those at any of the other departmental orchards, an area of 20 acres was laid out in 1904. Another block of a little over an acre of higher ground has lately been added for cherries, which were found unsuitable for lower situations.

A great number of fruits are being tried, the most promising being apples, to which the largest area is devoted. Of the varieties tried, Jonathan, Buncombe, Stone Pippin, and Five Crown have cropped the best; but hopes are entertained from Granny Smiths. Pomme de Neige, reported to be almost free from mildew, is just coming into bearing.

Pears are the next most promising crop. Young trees of Bartlett, Packham's Triumph, Packham's Late, and Winter Nelis have cropped a little, but it is too soon yet to say how they will do.

Triumph Peach is the only one which has yet given a crop: apparently the frosts are too severe for this class of fruit. Almonds have proved unsuitable; apricots have never cropped; whilst one nectarine, "Lusted's Xmas," has cropped and will be kept, though there is nothing special about it. Walnuts have also proved unsatisfactory. With the exceptions named, the walnut, apricot, and nectarine trees are being uprooted, and the ground planted with apples.

Robe de Sargent and D'Agen plums set a very heavy crop last year, but the fruit was soon cut down by frost. Two or three other varieties show a tendency to resist frost, and are being watched.

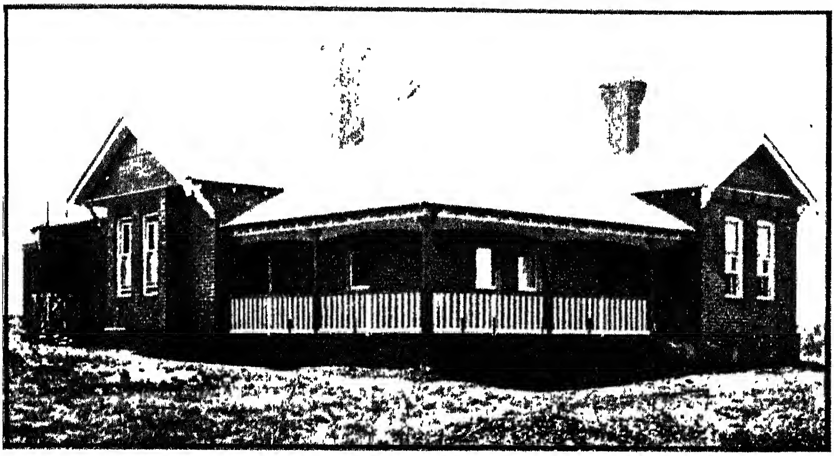
Quinces also set a heavy crop last year, but lost it, probably through frost. Last year was a disastrous one for the orchard, the frosts being unusually late and severe.

A number of American varieties of grapes ripen, and show good promise, the best being Bell's Seedling, Dr. Hindley, and another not yet identified.

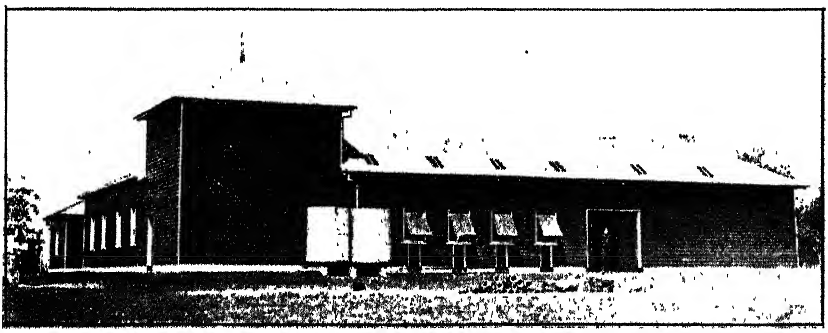
Apples and pears seem to be best able to withstand the severe frosts, and these will probably be the main fruits of the district.

The orchard is ploughed at the end of winter or early spring, and during the summer the cultivators are kept going to suppress weeds; but the cultural work is not as heavy as in dry districts, because there is less need to cultivate to conserve moisture. Wide, shallow drains are run between the rows at intervals, to carry off surface water, whilst allowing the horses and implements to pass.

An experiment in under-drainage has been made in the lower part of the orchard, an area of about 3 acres being treated. The laterals are 3-inch tile drains, 48 feet apart, varying from 18 inches to 3 feet in depth. A main 6-inch drain receives the output from the laterals, and conveys it beyond the boundary of the orchard. An open drain was tried, but it was found to silt very quickly. On the higher ground, a wet patch of about 1½ acres occurred, owing to a spring rising by soakage. This area was also under-drained in the same way. The total area so treated is thus 4½ acres. The distances and depths are experimental.



Manager's Cottage .Glen Innes Experiment Farm.



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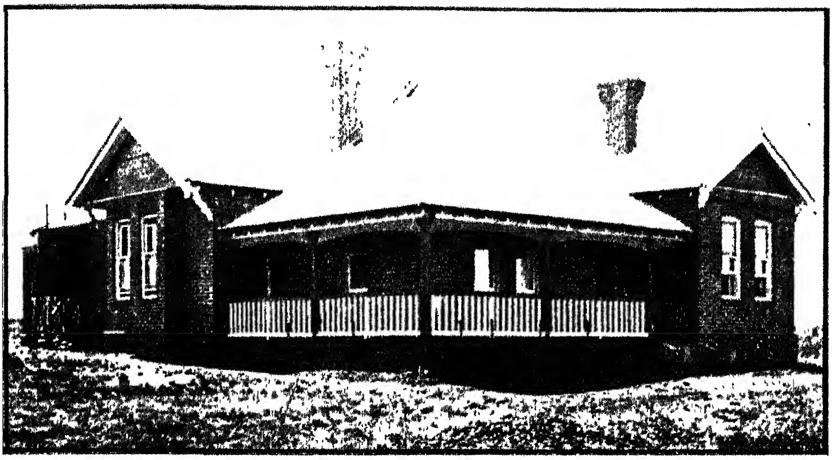

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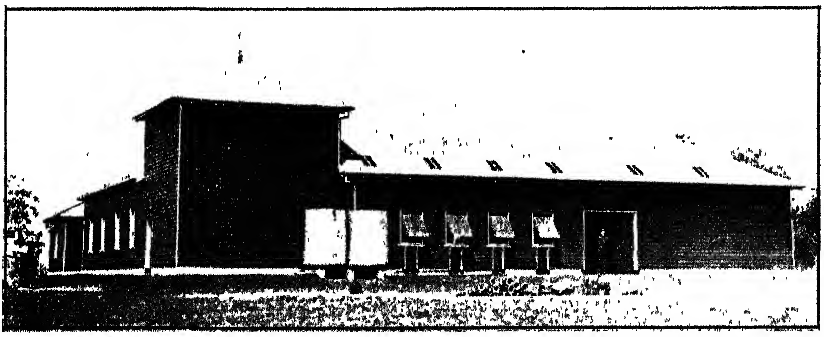

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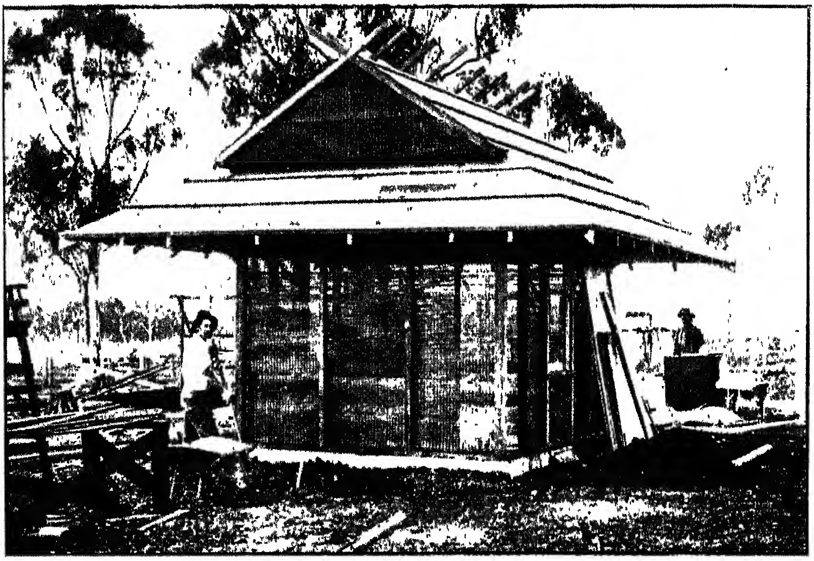


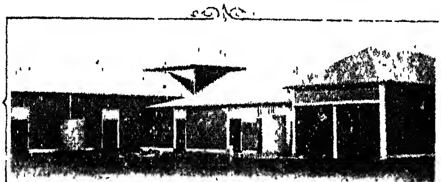
Dairy, in course of construction, Glen Innes Experiment Farm.

Grasses from Seed, Experiment Plots. Glen Innes Experiment Farm.

The free-stooling grass in the centre is *Phalaris commutata.* Adjoining this on the left is a check row of Perennial Rye, and next to that *Phalaris cærulescens.*

The orchard is surrounded by a breakwind composed of alternate trees of Oriental plane and pine. These trees have done well. Around this again is an Osage orange hedge. Another row of walnuts was provided inside the planes and pines, but they failed, and are being replaced by Packham's Triumph, Winter Cole, Bartlett and Winter Nelis pears.

But this year there will be no crop from the Glen Innes orchard, as on the night of the 11th October there was a frost of 12 degrees, and practically all the young fruit was cut off. This is, of course, a serious loss to the Department, and intending orchardists should learn a lesson from the occurrence. If fruit is to be grown on the extreme highlands of New England, late-blooming varieties should be selected, so as to minimise the risk.



Farmers' Bulletins.

As most of our readers know, the Department issues, in addition to the *Gazette*, a series of publications under the name of "Farmers' Bulletins," each dealing with a special subject and forming a brochure of interest to those concerned in the special matter dealt with. Some of these Bulletins are collections in handy consecutive form of serial articles which have run through the *Gazette;* others have been specially compiled, space not permitting of publication in the monthly journal.

The following is a list of the more recent Bulletins published, or shortly to be available. Residents of the State engaged in any form of rural industry may obtain free copies of such as may be of use to them by applying to the Under Secretary, Department of Agriculture, Sydney :—

29. Locusts in Australia and other countries.
30. Farmers' Calendar.
31. Certain Fungoid Diseases of Potatoes, including Irish blight.
32. Cultural Method for Wheat-growing in Dry Districts.
33. Irrigation with Artesian Water.
36. Sorghum.
37. Lucerne.
38. Cattle Dogs and Sheep Dogs.
39. Conference of Poultry Farmers, Hawkesbury Agricultural College, 1910.
41. Varieties of Wheat Recommended by the Department of Agriculture.
42. Conference of Wheat-growers, with Special Reference to Dry Farming.
43. Book-keeping for Farmers.

Nos. 34, 35, and 40, are not yet ready.

The Miller's Pest

THE MEDITERRANEAN FLOUR MOTH (*Ephestia Küehniella*, Zeller).

WALTER W. FROGGATT, F.L.S., Government Entomologist.

THOUGH this moth had probably, from a very early date, frequented flour mills and other places where it could deposit its eggs in suitable places for the web-spinning larvæ to feed and pupate, it was not recorded as a pest until 1877. In that year Dr. Kühn, of Hulle, found some small greyish-brown moths in a flour-mill in Germany, where much American wheat was used, and sent them to Professor Zeller, who described them two years later (*Stett. Ent. Zeit.*, page 466, 1879) as a new species of *Ephestia*, calling it *Küehniella* in honour of the collector of the specimens. He said: "On the wheaten flour the larvæ feed, and, according to the miller, they are particular in their tastes, and would not eat the rye meal."

This was the first that was heard of this flour-mill pest, which has since become cosmopolitan in its range, and is still spreading. Over Europe it made rapid headway; in 1885 Snellen dealt with its life history, illustrated with a fine plate of the moth (*Tydschr. Entom.*, page 237 and plate viii). It was first recorded from England by Barrett (*Entom. Month. Magazine*, vol. 23, page 255, 1886–7), who gave an interesting account of its discovery, and predicted that it would become a domestic insect like the common flour moth, *Pyralis farinalis*. Miss Ormerod wrote to the editor of *Insect Life* in 1889, giving an account of its establishment in England. In the end of 1889 an article, entitled "The So-called Mediterranean Flour Moth," was published, with illustrations of the moth's life history, in *Insect Life*. In this paper an account of the occurrence of this mill-pest was recorded from Canada; and it was stated that specimens of the moth had been taken in the United States some years before. At a meeting of the Entomological Society of France in December, 1892, M. Ragonet stated that a species of moth described by A. W. Scott, from Woollambi, New South Wales, under the name of *Hyphantidium sericarium* in the Proceedings of the Zoological Society of London as far back as 1859, was identical with this flour moth. M. J. Danysz, however, who published an important contribution to the study of its life history in France, 1893, considers it is a native of Europe.

In the Year Book of the United States Department of Agriculture for 1894, F. H. Chittenden, in an article on "The more important insects injurious to stored grain," said that this particular moth had spread over a large portion of the United States. He remarked: "That the Mediterranean flour moth has become so formidable in recent years is due to the higher and more equable temperature maintained in modern mills—a condition highly favourable to the development of the insect."

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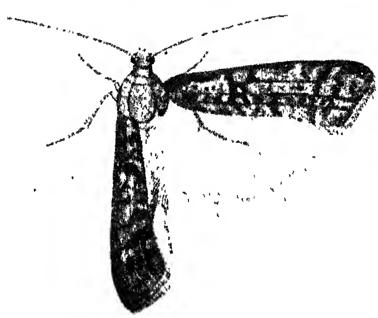

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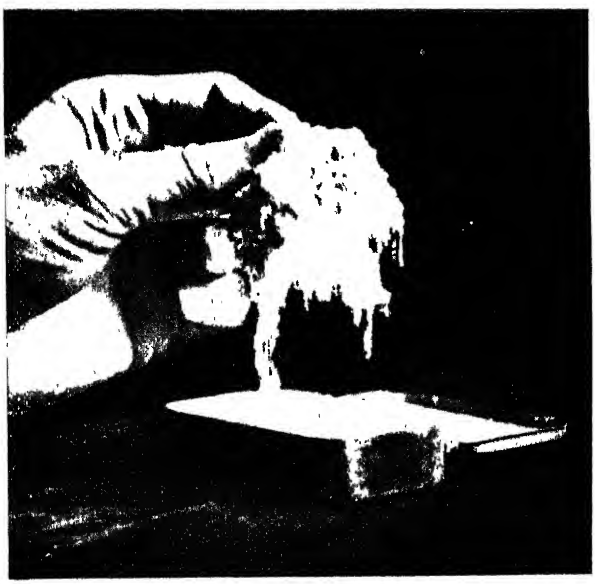

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MEDITERRANEAN FLOUR MOTH (*Ephestia Küehniella*, Zeller).

1—Eggs. 2—Caterpillar. [Enlarged.] 3—Pupa. [Enlarged.] 4—Moth. [Much enlarged.]
5—Showing the silken web of the moth in the flour.

The Pest in New South Wales.

In consequence of a controversy having been started in the *Australian Miller* newspaper in 1896 as to the existence of this particular mill-pest in Sydney, the officers of the Department of Agriculture made inquiries which resulted in the discovery that at least one large flour mill in Sydney was badly infested with the Mediterranean flour moth and her web-spinning larvae. In this *Gazette*, volume VII, 1896, Mr. Fuller gave an account of this moth, and suggestions how to deal with the pest. Since then it has been well known in the trade that there were a number of flour mills in this and the other Australian States that were badly infested with the Mediterranean flour moth, and that it was steadily spreading; but in all communications from flour millers we were asked, if mentioning the pest, not to state the place whence the specimens were sent, for fear of injury to their business. This was the case in Canada and the United States when the pest first appeared; but as it spread into the majority of the milling districts, this concealment of the trouble was abandoned, and the millers have faced the difficulty and treat their mills regularly for this pest.

The Genus *Ephestia* contains a number of small brown or lead-coloured moths, several of which, in the larval or caterpillar state, are well known enemies to grain, meal, and other stored vegetable products. *Ephestia interpunctella*, one of the most common, is sometimes confused with the true Mediterranean Flour Moth, and *Ephestia desuetella* is another species common in the West Indies.

Life History.

The Mediterranean Flour Moth (*Ephestia Küehniella*) measures slightly under an inch across the outspread wings; but when resting against the wall, its usual attitude in the daytime, its wings are folded down the sides of its body, so that it appears as a slender brown or greyish lead-coloured moth. The head, thorax, body, and front pair of wings are pale-lead colour, but on close examination one will notice a number of irregular black zig-zag lines or transverse bands across the fore wings. The hind wings are semi-transparent and dirty white in tint.

The female lays her eggs in the vicinity of the food, which consists, not only of flour meal, but also of bran, grain, and other fodder when she cannot find flour. Dissection of gravid females in the United States has demonstrated that a female contains over 400 eggs; so that one can understand how rapidly their numbers increase when a few moths become established within a mill. The caterpillars begin to feed as soon as they get to the flour, at the same time spinning silken threads into loose tubes, until the infested flour becomes matted together into felted lumps that hang loosely together when lifted up in the fingers. When these caterpillars become numerous they soon make their way all over the mill, getting into the shoots, elevators, and about the belting and screens, until everything becomes clogged and the mill has to be shut down to clean out the shoots and elevators. Here it will be found that, as the moths have hatched out, they have laid their eggs among the flour, until these felted masses are full of eggs and caterpillars in all stages of

development. The caterpillars are of the usual slender cylindrical form, about an inch in length, of a dirty white tint, and clothed with scattered bristles or coarse hairs.

Chittenden says: "From experiments conducted during the year at Washington, it is estimated that, under the most favourable conditions—*i.e.*, in the warmest weather—the life cycle consumes about five weeks. In its out-door life there are probably not more than two or three broods in a year; but in well heated mills or other buildings six or more generations may be produced."

Fumigation.

Before the value of hydrocyanic acid gas was discovered in dealing with the destruction of insect pests, bisulphide of carbon was recommended and used in Ameria, but the highly inflammable nature of bisulphide was a great drawback to its general use. Within the last few years hydrocyanic acid gas has been used in a great many different ways to kill vermin in houses and public buildings, and with such success that it will be no more trouble and no greater expense to destroy pests infesting flour mills than bugs and cockroaches in hotels and houses.

A Practical Demonstration.

Early in September last, specimens of flour infested with the Mediterranean flour moth were received from Mr. David Oram, manager of the Tamworth Milling Company, he stating that, though their mill was one of the newest in the district, it had within the last few months become infested with the moths forwarded. He asked if we could suggest any remedy. I advised that if the building were a modern up-to-date mill, which could be closed up so that it could be made comparatively air-tight, we should be able to kill out the pest by fumigation with hydrocyanic acid gas. I visited the mill, estimated the cost with the manager, and arranged to supervise the carrying out of the experiment.

The mill was shut down on the Saturday morning, and we commenced operations at once. Bagging was plugged into all the crevices of the roof, each window and crack was pasted round with strips of paper, and all the shoots and elevators were opened out so that the enclosed gas could circulate through everywhere. The building consisted of four floors, containing about 12,000 cubic feet of space in each, or a total of 48,000 cubic feet. As each floor was treated separately, belt-holes and ladder openings were closed with bags, the latter being fixed so that the operator could slip through quickly as he charged the floor, and then draw the bag over the opening. While the men were making the floors gas-tight, the chemicals were measured out, and the charge for each tin placed ready to mix.

On account of their cheapness, kerosene tins were used; but when using them it must be seen that they are perfectly sound and free from rusty spots, or the free acid will soon burn through. It is advisable to give them a coating inside with boiling pitch or tar, so that the thin coating acts as an enamel, and protects the tin from the action of the acid. This can be easily done by pouring a pint of it when hot into the tin, giving it a swill around, and then pouring it into the next tin, until they are all treated. If this is done a few days before they are wanted, the coating will be dry and hard.

Three tins were placed on each floor, and into each tin was measured 192 oz. of water; then the cyanide of potassium was broken up with a hammer (each big lump placed under the fold of a corn sack, so that the bits would not fly about, for this is a deadly poison) into pieces as big as a walnut, or not more than a couple of inches square. The broken cyanide was then weighed into parcels of 1 lb., and charges of 2 lb. each were placed in light, cheap paper bags. Two of these 2-lb. packages were placed beside each tin; and then the jars of sulphuric acid were carried up through the building, working downward from the top floor. With a measuring glass 96 oz. of sulphuric acid were measured out, and poured gently into the water in the tin. Care must be taken not to let the acid splash one's face or hands, as it burns very badly, and if it gets on clothes or boots it will burn holes through them; so that the measuring out and handling of the acid is the most delicate part of the work, and must be carefully done.

Working downward, the acid was added to the water in each tin, and when the contents of the last tin on the ground-floor were mixed, the operator ascended to the top floor with an assistant. (It is advisable, in case of accidents, to have another person with one, though only one should handle the cyanide.) Starting at the tin furthest from the trap door, the two bags of cyanide were dropped into the combined acid and water, and as soon as the liquid soaked the paper the generation of the gas commenced, the liquid boiling up, and giving off a fine white gas. The moment the bags were dropped into the tin the operator hurried on to the next tin, dropped in the second lot of cyanide bags, and the operation was repeated at the third tin, near the trap door, down which he and the waiting assistant then hurried, drawing the bag over the opening as they descended. This procedure was gone through with each floor; one door on the ground-floor, left open to the last, being closed up with pasted paper, and locked as soon as we came out.

The generators (kerosene tins) could be watched through the windows of the ground floor, and the contents could be observed boiling up madly to the rim, so that they were charged to their utmost capacity. More tins would be required if there was a larger floor space in another mill, as a little was splashed over in several of the tins and spotted the floor. Looking through the windows, it could be seen that the room was filling with a fine blue haze (the liberated gas), and within twenty minutes it was evident that the gas was finding its way upward, as about a dozen sparrows resting under the eaves of the roof came tumbling down as dead as if they had been shot, so rapidly had the deadly fumes overpowered them.

The mill was closed up about 4 p.m. on the Saturday afternoon, and we all met at 9 a.m. on the Sunday morning, when we opened up the mill from top to bottom, though care was taken when first going in not to breathe any of the fumes that might be remaining in the building. It was found that, with the exception of a very faint trace of a smell of gas on the ground floor, all the gas had worked out during the night.

A careful examination was made from top to bottom to see if there were any living moths or larvæ on the walls or among the waste flour; but with

the exception of two moths proved to have come from outside, there was nothing alive within the fumigated mill. Swarms of dead blowflies were lying round the windows, and the floors were spotted with hundreds of dead moths. Minute inspection of infested flour in the elevators and shoots proved that every caterpillar and moth infesting them was dead; and quantities of the infested flour collected in the elevators and placed in observation jars show no signs of any eggs having developed.

The Result.

After careful observation up to 8th October, Mr. Oram has written the following letter to the Entomological Branch, which he has kindly allowed me, in the interest of the millers of the State, to publish:—

Tamworth Milling Co., Ltd.,
Tamworth, 8 October, 1910.

Dear Sir,

With reference to the destruction of the Mediterranean Moth by fumigation with hydrocyanic acid gas, which was carried out under your supervision, I am pleased to state that the destruction of the pest was complete within the building; and as far as I can see the eggs deposited by the moth about the machinery, elevators and spouting have all been destroyed, so that the eradication of the moth should now be complete. I shall be pleased to give any information to any miller or others who are troubled with this pest.

Yours truly,
(The Tamworth Milling Co., Ltd),
DAVID ORAM,
General Manager.

With the fumigation of this mill, all the outer walls and other buildings have been sprayed with oil emulsion to destroy any larvæ or eggs that might otherwise reinfest the mill.

Formulæ for Generating Hydrocyanic Acid Gas.

The following are the formulæ worked out by Mr. Chittenden, of the United States Bureau of Entomology:—

To 1,000 cubic feet of space for large buildings such as mills, stores, &c., 1 lb. of cyanide, 1 lb. of sulphuric acid, and 48 oz. of water. The usual formula for 100 cubic feet of space in a room in a dwelling-house, where the rooms can be practically made airtight, is 1 : 1 : 3.

Extensive experiments, carried out both here and in America, show that 1 oz. of cyanide of potassium will give the best results when placed in a mixture of 1 oz. of acid blended with 3 oz. of water. It has often been the habit of our fumigators to add a little more acid than the ounce, but the only actual result is the more rapid generation of the gas. One oz. of acid with 3 oz. of water forms a solution that will dissolve an ounce of cyanide, and convert it into hydrocyanic acid gas, leaving potassium sulphate and water. Woglum ("Fumigation Investigations in California," *U.S. Bulletin, Entom.*, 79, 1909) says:

Potassium sulphate, a solid, is the by-product resulting from the reaction by which hydrocyanic acid gas is produced. Water dissolves the potassium sulphate as it forms, and prevents it from coating the lumps of cyanide not yet in solution. In the presence of an insufficient amount of water, the potassium sulphate is not completely dissolved, but forms a coating on the pieces of cyanide, preventing the sulphuric acid from penetrating to it, and thereby retarding, or even in part preventing, the reaction.

When the residue left in the generator is found after the fumigation to be solid or "frozen," instead of liquid, it has been caused, as explained in Woglum's paper, by an insufficient amount of water, or a large excess of sulphuric acid.

The blending of the acid and water should not be done until just before the cyanide is added, because as soon as the acid mixes with the water it gives off heat, and the heated solution dissolves the cyanide much more rapidly and completely than when the heat has been given off and the solution has cooled down. Never place the acid in the generator before the water, as there is much more danger of splashing and burning; and never place the cyanide in the water before the acid has been added, for the reaction is so great that it will splash all over the place.

Cost.

The whole cost of materials, cyanide and acid, sent to Tamworth was under £4. Twelve clean kerosene tins were required, a graduated measuring glass, scales for measuring and weighing the chemicals, and a couple of dozen small paper bags.

Three men working for a day could easily fix up a mill of this size for fumigation; and when once a mill has been prepared for gas, the work at another time would be very much less, for it would only mean the pasting up of the doors and windows.

Materials.

Cyanide of potassium is sold at 10d. per pound in tins. It is a hard, white substance, which soon absorbs the moisture from the atmosphere if not closely sealed up, and if kept any time should be placed in a wide-mouthed jar, as it eats through tins with the least damp. It is a deadly poison, and care should be taken when breaking it up not to leave any bits lying about on the ground or floor; and it would be advisable to burn the bag upon which it has been broken up for the generator. Wash the hands well after handling it.

Sulphuric acid is a thick, heavy, poisonous fluid, but the chief danger is its burning, corrosive properties previously noticed; so that any drop splashing the skin should be washed off at once. Baking-soda applied as a paste to a burn caused by sulphuric acid will relieve the pain. It costs 1½d. per pound, and is sold in jars.

Hydrocyanic acid gas is a very volatile, visible gas when generated. It can be easily detected by its peculiar smell, while a whiff of it mixed with the air gives one a sudden, curious dry taste in the mouth that is an admirable warning not to breathe any more. Taken pure into the lungs, it causes sudden death; therefore, care must be taken not to inhale the fumes; but, with ordinary care, there is very little danger to the operator, and during all the time people have been using this gas for orchard work and fumigating fruit in chambers, we have no record of a single accident.

This gas, when properly enclosed, will kill all insect pests with the exception of certain groups of beetles, particularly the grain weevils; therefore, if the grain weevils, so common in mills and grain stores, are found alive after fumigation with this gas, it is no proof that the gas has been harmless to other pests.

Houses infested with cockroaches, or, worse still, with bed bugs, can be successfully treated with hydrocyanic acid gas, if the rooms can be vacated by the inmates, and securely closed up for six or eight hours.


MAP
OF
NEW SOUTH WALES
shewing
areas where DAIRYING is carried on
SCALE
Territorial Division Boundaries shewn thus
County ... do. do. do.
Railways ... do. do.
Highly suitable for Specialised Dairying wherever the Soil is good.
Suitable for Mixed Farming to include Dairying.
AUSTRALIA
QUEENSLAND
SOUTH AUSTRALIA
VICTORIA
PACIFIC OCEAN
TASMAN SEA
WESTERN DIVISION
CENTRAL DIVISION
EASTERN DIVISION

Experiments Supervision Committee.

In July last the late Minister of Agriculture appointed a Departmental Committee to control the experiment work of the Department, in both field and laboratory; the objects being to ensure better supervision, to prevent overlapping and waste of energy, to avoid duplication of experiments which have already been carried out elsewhere under conditions which clearly apply to this State, and to collate and publish, with their deductions, results of series of experiments on similar lines in different parts of the State.

The Committee consists of Mr. H. C. L. Anderson, Under Secretary (Chairman); Mr. Geo. Valder, Chief Inspector of Agriculture; Mr. F. B. Guthrie, Departmental Chemist; Mr. S. T. D. Symons, M.R.C.V.S., Chief Inspector of Stock; Mr. Geo. L. Sutton, Wheat Experimentalist; Dr. Frank Tidswell, M.B., Ch.M., D.P.H., Director of the Bureau of Microbiology; and Mr. G. P. Darnell-Smith, Assistant Microbiologist.

For the future, no experiment will be commenced by Departmental officers without the approval of the Committee, who will also examine the details of sowing, harvesting, calculation of results, &c.; and the Committee will, from time to time, consider the collected evidence from experiments and publish their conclusions for general information.

An alleged Insect Destroyer of Prickly Pear.

Some time ago reports were published in the Press that a cochineal insect had been introduced into the Punjab, India, some fifty years ago, and that it had destroyed all the prickly-pear in that part of India. Mr. W. W. Froggatt, Government Entomologist, communicated with Mr. W. R. Lefroy, Imperial Entomologist, Pusa, Bengal, and has now received the following reply:—

> It is on record that *Coccus cacti* was introduced to afford cochineal, but it never established itself properly and is now not known. In North India, *Coccus indicus* is known on *Opuntia* and did yield cochineal, but it is rare and of little value. I do not think either would affect your *Opuntia*, and in India large sums are spent on cutting down prickly-pear scrubs near towns, &c., as they harbour snakes.

Dairying Map of New South Wales.

This map, prepared under the supervision of the Dairy Expert of the Department, shows two distinct groups of areas—(1) highly suitable for specialised dairying wherever the soil is good; (2) suitable for mixed farming to include dairying. In both groups dairying is carried on, but in the localities hatched green, dairy-farmers should mix their operations with the growth of cereals and other rural pursuits adapted to the surrounding district. Owing to the recent run of good seasons in the interior of the State, farmers have been specialising in dairying on the western slopes and plains. This may lead to disaster when the conditions return to what has hitherto been the normal. It cannot be too strongly impressed upon farmers that these localities are *not* suitable for specialised dairying.

Fruit Canning and Bottling

W. J. ALLEN AND S. A. HOGG.

FROM year to year we find that the consumption of fruit, either in the fresh or preserved state, is increasing, and when one thinks of the benefits to be derived from a fruit diet during the hotter months of the year, as compared with the meat three times a day menu, which until quite recently held undisputed sway in nearly every household in Australia, it is matter for congratulation that our people have at last been awakened, and also that the excellence of the home-made product is such that it has so quickly gained in

General View of Cannery.

favour, and commended itself to the consumer. It must be borne in mind that but a few years back the bulk of the preserved fruits used in this country were imported from the United States or the Old Country; but with the increase in the fruit-growing industry, the question of disposal of crops when the trees came into bearing compelled those engaged in making jams in a small way to increase their operations, and also to look to the improvement of their methods. The result has been the establishment of jam factories with all up-to-date appliances for handling large quantities of fruit.

At the present time the canning of fruits and converting them into jam furnishes profitable employment for hundreds of hands during the season; and as our factories turn out only high-grade products, they are finding an ever-increasing demand for same. In our large jam factories the processing of fruits has become almost a mechanical operation, and the cost of handling fruit and tins has been reduced to a minimum. Making the tins, testing, filling, capping, and labelling are all done by machinery, and require but a few hands to supervise the whole operation. By this means the work is quickly and cheaply done.

It is not so many years ago that Australian jam did not commend itself too highly to the Australian consumer, but now our products are second to none on the market, and have practically ousted the imported article. In Sydney at the present time we have some very large jam factories, which yearly convert into jam and canned fruits hundreds of tons of fruit.

A frequent complaint from the proprietors is a shortage of the higher-grade peaches and apricots for canning purposes. It would, therefore, be well for those growers who are situated in districts where peaches thrive well, and where there are not too many pests to fight, to grow largely of those varieties which are most suitable for canning purposes.

Those who have fruit at their command, whether it be on the farm, station, orchard, or city, can with very little trouble put up sufficient canned fruit and jams to supply their wants throughout the year. The fruits may be put up in glass bottles or tins. At many of our country shows one is confronted by very fine displays of such home-made products, which reflect the highest credit on the operators. While requiring the exercise of scientific principles, the art of canning and jam making is yet so simple when clearly understood that it is of easy application, whether practised on a large scale or in the more modest scale of the kitchen.

Heat is the all sufficient, safe, and sure steriliser for the canning business. It is sure death to all ferment organisms, purifying in its effect, and imparting no hurtful property or quality. A clear understanding of this principle leads at once to successful work in canning fruits or converting them into jam. Success depends on careful work in every particular, in filling and sealing the cans, and in sterilising them during the process of cooking.

It must be borne in mind that only sound and high-grade fruits should be used, and that cleanliness is one of the prime factors to success. It is erroneously thought by some that inferior and low-grade fruits are suitable for canning, and only too often are such fruits used for this purpose, greatly to the detriment of all concerned. On this subject, it may be well to mention that the question of size is one of importance, and the following list will act as a guide on this point:—

Peaches should measure not less than $2\frac{1}{2}$ inches in diameter; Bartlett pears (commonly known as the Williams or Williams' Bon Chrétien), $2\frac{1}{2}$ inches and upwards; cherries, $\frac{3}{4}$ of an inch; plums, not more than ten to the pound; apricots, not more than eight or nine to the pound. What is really required are neither small nor very large fruits, but medium to large in size, so as to

facilitate the packing, and to do away with the necessity of having to divide them into more than two parts.

Before going into the details of canning, it will not be out of place to give the names of a few of the most suitable varieties to be used for this purpose. The following fruits are some of the best of their respective kinds, viz.:—

Apricots.—Hemskirke, Mansfield Seedling, Alsace, Moorpark, and Peach.

Cherries.—Florence, Bigarreau Napoleon, St. Margaret, and Montmorency (the last-named variety is also the most suitable for jam-making).

Figs.—Brown Genoa, White Genoa, Brown Turkey, and White Adriatic.

Peaches.—(Freestone) Elberta, Early Crawford, and Lovell; (clingstone) Lemon Cling, Orange Cling, California, Nicholl's Cling. The above are all yellow-fleshed varieties. For white cling peaches, McKevitt's Late and Large Early White.

Plums.—Jefferson, Magnum Bonum, Angelina Burdette, and Giant Prune.

Pears.—Bartlett, Easter Beurré, Le Conte, Kieffer's Hybrid.

Quinces.—Missouri, Champion, Portugal, and Pear-shaped.

This article is written with a view of assisting the small canners, and in no way claims, in its illustrations, the modern appliances of a large factory, but, on the contrary, simply gives the necessary requisites, from which a few hints may be gathered. The articles in use are substantial, cheap, and answer the purpose. In the present instance steam is being used as a medium for boiling; but although this is very convenient, it is not indispensable, and a copper for a small quantity, or a 200-gallon tank cut in halves and set in bricks, will answer for a limited output.

Selection of Fruits.

These should be ripe, but not soft (this does not apply to pears). All fruit should be handled carefully, and it is advisable to pick into small cases, so as to avoid bruising—say not more than 30 lb in each case. Upon arriving at the cannery, the first process is that of grading. The table shown in Fig. 1

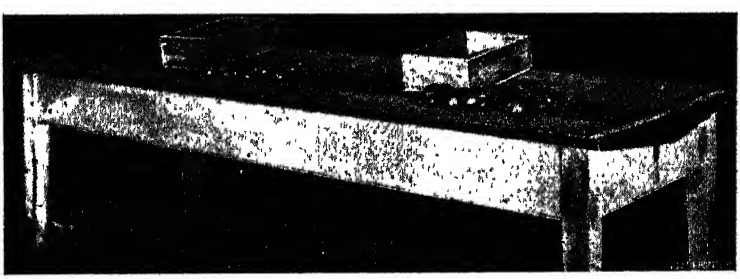


Fig. 1.—Grading Table.

illustrates the grading-table, which measures 10 ft. x 4 ft. x 2 ft. 9 in. in height, depression $2\frac{1}{2}$ inches. Upon this the fruit is gently placed and graded. It will be observed that this table is lower in the centre than the surrounding edges. The advantage in having it thus is, that with such a

formation, the fruit always inclines towards the centre, and prevents, in a great measure, the tendency to fall upon the floor.

After the fruit has been graded by hand, it is placed in convenient boxes or buckets and carried across to the packing-table, which is illustrated in Fig. 2.

Packing-table (Fig. 2).—As shown, this table is wholly constructed of wood, with a trough in the centre. This is made in the shape of a V,

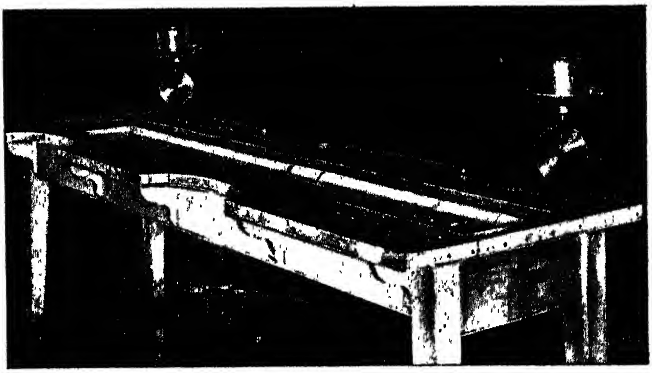


Fig. 2.—Packing-table.

being 14 inches across and 7 inches in depth. Spaces are cut out, so as to accommodate four packers, and the edge is surrounded with galvanized hoop-iron, projecting above the table half an inch. This is to prevent the operator becoming splashed with water. Into this trough the fruit is emptied (having been previously peeled, or pitted when necessary—this will be explained later on), washed, and packed in the cans, care being taken to place the same weight of fruit in each can. As shown in Fig. 2, small scales may be used as a check.

Fig. 3.—Syrup Tank and Table.

Syrup Tank and Table (Fig. 3).—This table is constructed mainly of wood, with a galvanized or enamelled trough let into the front. The height is 2 ft. 9 in., and the table is 4 feet long by 3 feet in breadth. The surface is grooved, starting 2 feet from the back, and running in the direction of the trough. These grooves are so made, that in case of any syrup being spilt it will be conveyed into the trough (trough 24 in. x 12 in. x 6 in.), a tap being inserted into the bottom of the latter by which such surplus syrup may be drawn off, strained, and reused. Under this table stands a tank containing 10 gallons of syrup, which is used

for filling the cans. A little in front of the tank, to the left, is placed a slide—known as a gauge—which is used as a check in filling the cans. The gauge is set at such an angle that it will discharge any superfluous syrup; and it is placed inside the trough, and the tins slide down it, so as to ensure equal filling. It will be noticed in the illustration that a single can is standing under the tap, but usually a crate containing six cans is used.

Soldering-table and Accessories (Fig. 4).—This table is of no special construction, but it is advisable to place on it a sheet of galvanized iron in the vicinity of the work. Also, all the necessary materials should be ready to hand.

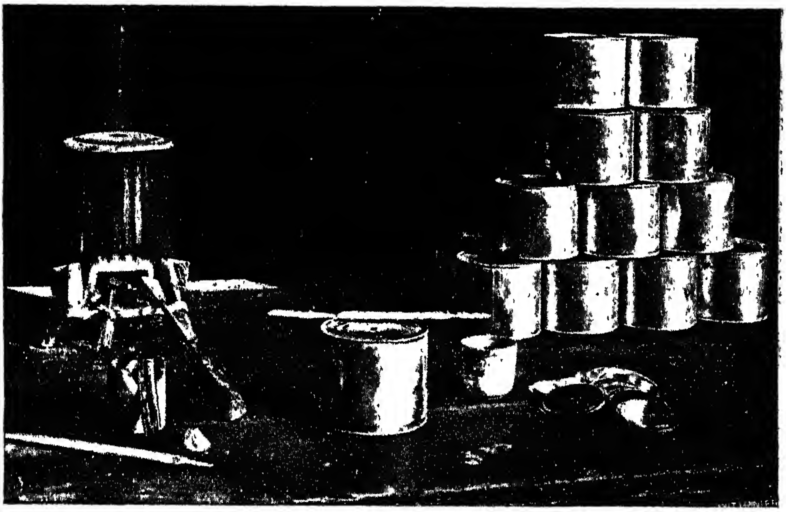


Fig. 4.—Soldering Table and Accessories.

Materials used in Soldering.—Copper, lead, tin, zinc, sal-ammoniac (ammonium chloride), muriatic acid (hydrochloric acid).

Copper.—Copper-bit or soldering-iron may be purchased of any weight, or copper may be procured in bars, and converted into any shape required.

Lead and Tin.—These comprise the component parts of solder. To make good solder, melt down equal parts lead and tin at the same time, and pour into moulds not more than ½ inch in breadth.

Soldering Fluid.—Muriatic acid, zinc, and water. Make the following solution:—Take 1 pint acid, and place in earthenware jar; then add sufficient zinc until all ebullition has ceased. Strain, and add ¼ pint of water. This is for tin only.

Sal-ammoniac.—This acts as a flux with copper, and is used in cleaning the soldering-iron; but should be kept away from all steel tools, as it rusts them very severely.

Horsehair Brush.—This can be made by placing the hair between a piece of bent tin, and then squeezing it together.

Tinning the Iron.—With a rasp, clean the iron until it is bright—that is, after it has been heated sufficiently. At this stage you can let it get red-hot, and then rasp it; then allow the iron to return to a dull heat. Having placed a piece of solder somewhere handy, you dip the iron into the zinc

solution, then apply it to the sal-ammoniac, at the same time rubbing the iron with solder. By degrees the iron will become tinned. For this purpose, the zinc solution is not broken down to the same extent as that used for soldering the cans, and should contain some sal ammoniac, which may be powdered and dissolved in it.

Shake off any superfluous solder.

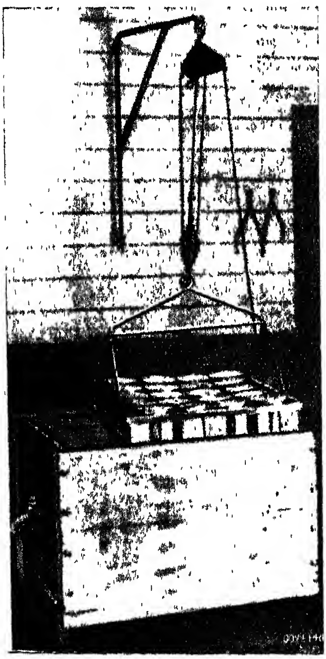


Fig. 5.—Cooking Bath and Crane.

Cooking Bath, Lifting Crane, Crate, and Tongs (Fig. 5).—This bath, 3 ft. x 2 ft. 6 in. x 2 ft. in depth, is made of wood and lined with sheet-copper or iron; inside, on the bottom, is a steam-coil; resting on top is an iron crate containing the tins, which are raised or lowered by a pulley as occasion may demand. Two pairs of tongs are provided for handling the tins whilst hot.

Steam Retort (Fig. 6).—This is a square steam-tight receptacle, which may be used, after the tins have been tested, for cooking either fruit, vegetables, meats, &c., the advantage of a retort being that as the temperature can be raised far above boiling point, the time of cooking is correspondingly less. For instance, in the cooking of peas, these are shelled, washed, and placed in boiling water for twenty minutes; the water can then be drained off and cans filled to within half an inch of the tops with peas; pour in 10 per cent. brine to within a quarter of an inch of the aperture (a little sugar being added), and cap, leaving a small hole in the lids for exhausting. They are boiled for ten minutes; the hole is then soldered up. If cooked in open bath containing saline solution, at 230 degrees F., one hour; if in retort, at 240 degrees F., thirty-five minutes.

The description of several more fittings and apparatus for a small cannery will be given before going on to the various methods of preserving fruit. It will be understood that although many of the articles shown are of a labour-saving kind, they are by no means indispensable; but where the preparation of more than the usual amount of canned or bottled fruit required for domestic use is in view, a small cannery, properly equipped, is more or less essential to cope with a quantity of fruit during the limited time it is available.

Fig. 7.—Steam-jacketed kettle, used for cooking jam.

Fig. 8.—A convenient wooden truck, with castor-wheels, for carrying tins, &c.; measurement, 3 ft. x 2 ft. 6 in. x 1 ft. 3 in. high.

Fig. 9.—A handy method of storing quantities of canned fruits in the cannery.

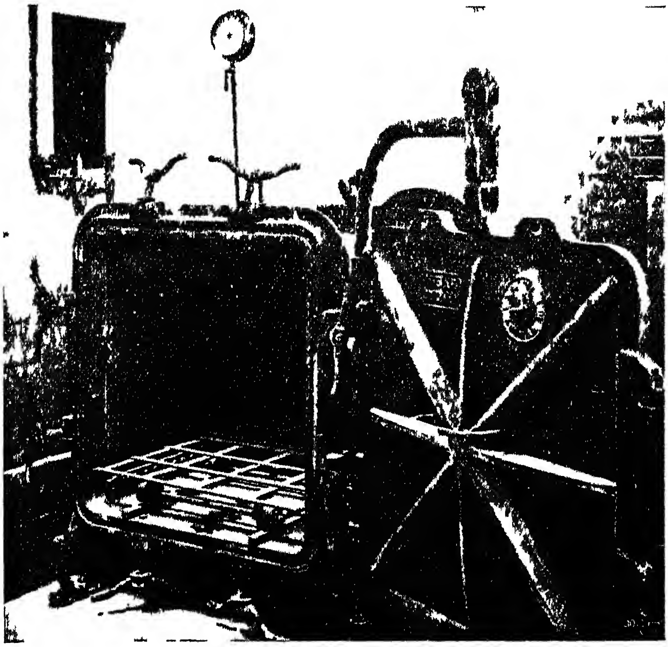


Fig 6 —Steam Retort.

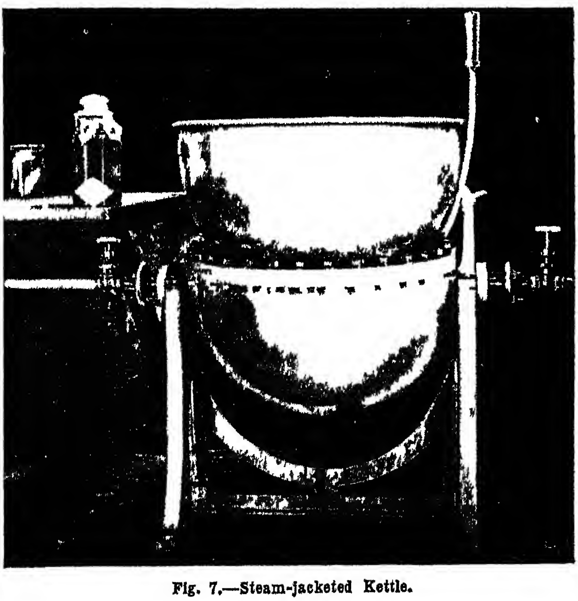


Fig. 7.—Steam-jacketed Kettle.

Fig. 10.—Showing size of cans used for pulp, canned fruits, and jams. Pulp, 10 lb. and 5 lb.; canned fruit, $2\frac{1}{2}$ lb.; and jam, 1 lb.

Fig. 11.—Glass jar, wrapped with a wet towel, prior to its being filled with hot fruit or syrup; wooden ladle and enamelled preserving-pan.

Fig. 12.—A crate of any required size, made to fit into an ordinary boiling copper, the base being of wood surmounted by a perforated-iron tray, in which the bottles are placed.

Fig. 13.—Square wooden crate, with divisions for holding glass jars during boiling.

Fig. 14.—Table on which are placed some of the accessories used in bottling, such as scales, scoops, bottle-brushes, spoons, ladle, and a strainer; leaning up against the strainer are two perforated divisions. These are covered with cotton-wool, and placed one above the other in the box through which the syrup is strained.

Fig. 15.—Bottles in general use, showing size and the methods adopted in fastening on the tops.

Fig. 16.—Wire scalding-basket.

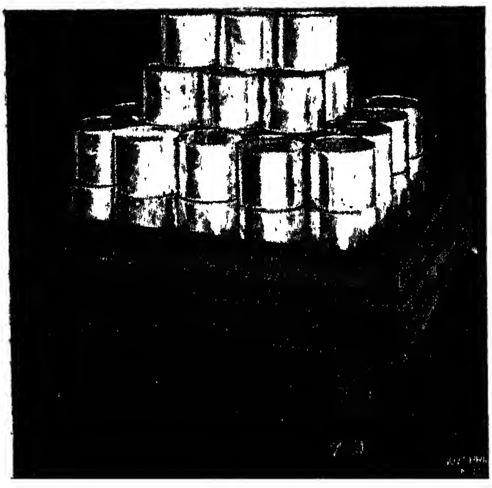


Fig. 8.—Truck.

Preserving Fruit in Tins.

Accepting sterilisation as the medium in canning, the methods adopted are as follows:—

Peaches.—Having graded and peeled the fruit, either by hand or machine, halved it, and removed the stones, pack the peaches in the tins (taking care whilst doing so to place fruit so as to leave a hollow in the centre of the tin, to facilitate the filling of the latter with the syrup); the cans should be filled with syrup to within half an inch of the top. The strength of syrup should not be less than 30 per cent,*—that is, 3 lb. of sugar to a gallon of water. Before placing on the caps for soldering, care should be taken to remove any trace of syrup that may have been spilt on the rim. This is done with a brush and hot water. In every case this detail must be attended to, otherwise the solder will not take. The lids are now soldered down, leaving a small hole in the centre. Place the cans in boiling water for seven minutes, remove, seal hole, and cook in boiling water about twenty-three minutes for freestone, and

* In all cases the percentages of syrups given here are arrived at by measurement; these do not correspond with the densities as shown by saccharometer; for instance, a 25 per cent. syrup by measurement reads on saccharometer 16 per cent.

about thirty minutes for clingstone, according to ripeness. Remove and cool. Whether the tins should be immersed whilst the vent is open or kept just above the surface is not material; we prefer the latter method; at the same time, if the vent is very small it is unlikely that any water will get into the tins.

For large tins, holding from 5 to 10 lb. of fruit in good condition for canning—*i.e.*, properly ripe, but not overripe—exhaust five minutes; then cook twenty-five minutes if cooled immediately afterwards, but if not, cook for nine minutes, as it takes some time to cool, during which the process of cooking continues. Clingstone peaches require a few minutes longer in every case than freestones—say, about seven minutes longer. Also firm or not quite ripe fruit requires like treatment.

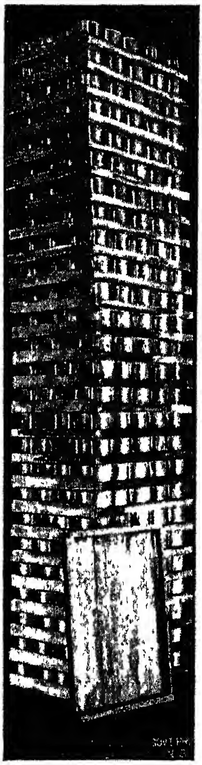


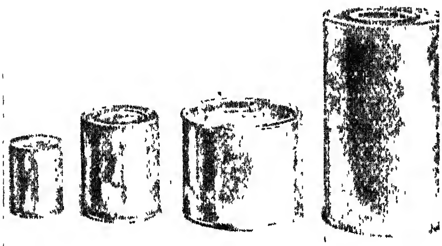
Fig. 9.—Stack of Cans.

Nectarines.—Give this fruit the same treatment and time of cooking as clingstone peaches, except that they need not be peeled unless desired.

Pears.—This fruit should be as ripe as can be conveniently handled. This can only be carried out where the fruit is brought to the cannery in a green state and allowed to ripen, or ripened in an adjoining building, giving attention to the fruit daily, and selecting from time to time those which are sufficiently ripe.

Peeling Pears.—Make a solution of a half pound of caustic soda (Greenbanks') to one gallon of water, and bring to a boil. Place in a perforated bucket or wire basket (see Fig. 16), say about two dozen pears, and immerse in the boiling solution for from three to five minutes, according to ripeness. Remove and wash in fresh water. This water should be kept running. It will be found that the skins will rub off easily by hand with the minimum loss of flesh. They should now be removed and placed in a weak saline or acid (citric acid) bath; the salt or acid should only just be perceptible to the palate. While in this bath they should be cut in halves, cored, and the stems removed or allowed to remain, according to choice. They need not, however, remain for any length of time in this saline solution, but may be packed directly into the cans. As the tins are packed, turn them upside down to drain. Next fill to within half an inch of the lid with syrup, 15 per cent. for Bartlett or Easter Beurré, and 25 per cent. for other canning varieties. Solder on caps, leaving a small hole in centre; exhaust by placing tins in boiling water, to within an inch of the top, for five minutes, remove, seal up hole (this in every case should be done immediately if the cooking bath is being used to exhaust in, then the cans need only be raised a convenient height and sealed in the crate at once). Cook from twelve to fifteen minutes for Bartlett's or Easter Beurrés, or from fifteen to thirty minutes for other varieties. Remove and cool.

Apricots.—Select fruit of even ripeness, size, and quality; cut in halves, remove stones, wash, and pack in cans; fill cans to within half an inch of the lid, and add syrup, 30 per cent. Solder on cap, leaving a small hole in the centre of the lid; exhaust by placing cans in boiling water five minutes, seal up hole, and cook fifteen to twenty-five minutes, according to ripeness.



1 lb. 2½ lb. 5 lb. 10 lb.

Fig. 10.—Jam, canned-fruit, and pulp cans.

Plums.—Select even grade and ripeness. The stones may be removed or allowed to remain, according to size and variety. Pack in tins, fill to within half an inch of the lid; add from 15 to 30 per cent. syrup; solder on cap, leaving a small hole in the centre. Place cans in boiling water for five minutes if stones are removed, eight minutes if stones are in fruit. Seal immediately, and cook from fifteen to twenty-five minutes. Remove and cool.

Grapes.—Select a Muscat variety (white). These should be picked before being perfectly ripe. Remove berries from the stalks, but aim at leaving the stems on the berries. Pack in cans, and fill to within half an inch of lid, with 15 per cent. syrup. Solder on lid, leaving small hole in centre; place in boiling water five minutes; seal up hole, and cook ten minutes. Remove and cool.

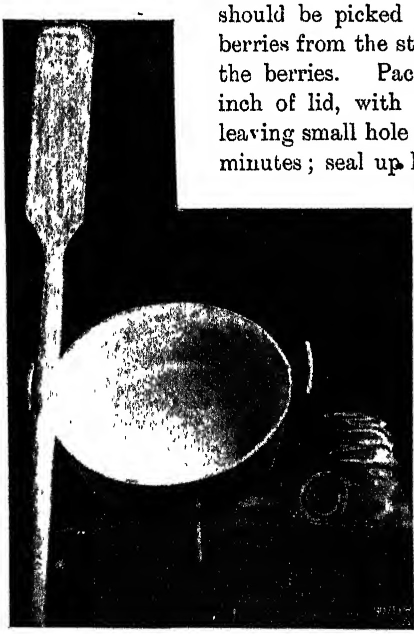


Fig. 11.

Quinces.—Select ripe fruit, peel, quarter, remove cores, and pack in cans; fill to within half an inch of the lid with 30 per cent. syrup; solder on lids, leaving small hole in the centre. Place cans in boiling water for five minutes. Seal up hole, and cook thirty-five to forty-five minutes. Remove and cool.

Tomatoes.—Select medium-sized, firm, ripe, red fruit. The stems may be left on. Pack in the cans and fill to within half an inch of top with a solution in the proportion of ½ lb. salt, ½ lb. sugar, 1 gallon water. Place cans in boiling water for five minutes, seal up hole, and cook from five to eight minutes. Remove and cool; but about half the above time will suffice if not cooled.

Cleaning and Testing Cans.—As a precaution, all tins should be washed before packing fruit in them, as there is a certain degree of danger of the presence in them of chloride of zinc and other foreign matter, which at some time may become deleterious.

Testing.—In the large modern factories this is done by machinery before the tins are packed, but the smaller factories will have to resort to testing in the cooking bath. This is carried on after the tins have been exhausted and the small vent sealed. The tins are then immersed in the boiling water, and the presence of air bubbles escaping from them denotes a faulty tin, which must be removed, and the leak soldered up; then re-test the tins in boiling water.

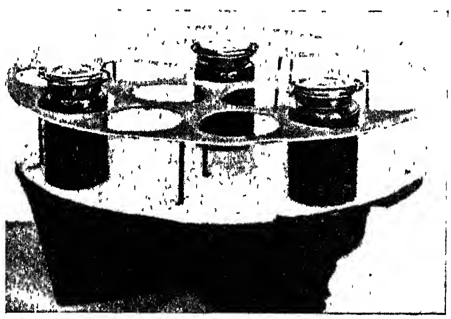


Fig. 12.—Iron Crate to hold Preserving Jars.

Bottling Fruits.

The principles and process of bottling are practically the same as those of canning, the adoption of rubber rings and fastenings doing away with the necessity for solder. The fruit is packed in the bottles in precisely the same way as in the cans, and filled to within half-inch of the brim with cold or hot syrup, according to whether the bottles are going to be placed in cold or hot water. The lids in either case are fastened on, omitting the rubber rings; the bottles are placed in the crate, as shown in Figs. 12 and 13, and brought to the boil, and cooked according to the time stated as used in canning. The caps are now removed and the bottles filled to overflowing with syrup at a temperature of at least 200 degrees F., the bands put on, and immediately the caps are fastened down.

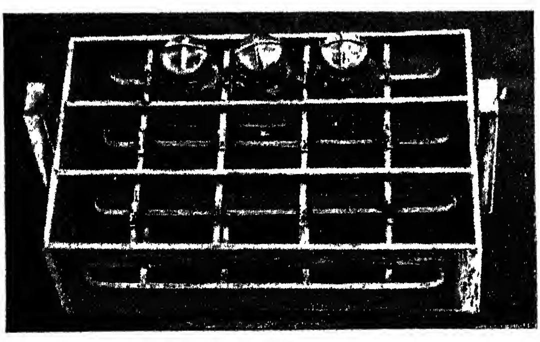


Fig. 13.—Wooden Crate to hold Glass Jars.

Another method is to cook the fruit in an enamelled or copper preserving-pan prior to placing it in the bottles, which should be filled immediately the fruit is cooked. But in using this method, care must be taken not to break the bottles while filling. (See explanation to Fig. 11.)

Still another method, but one which is not recommended owing to the absorption of the syrup by the fruit, is as follows:—Pack the bottles with fruit, fill with syrup to overflowing, put on rubber rings, and fasten down lid, immerse in water, and cook as directed for canning similar fruits. No further attention is necessary except testing bottles after cooling. This is done by removing the fastening and lifting the bottle by the lid; if the lid remains firm it indicates that it is hermetically sealed and in proper condition for putting away and keeping.

Testing the Bottled Fruit after Fixing the Tops.

Ten minutes after fixing on the tops or lids, the bottle may be turned upside down; and if any syrup exudes, the bottle must be reheated, filled to overflowing with boiling syrup, a new rubber affixed, and again fastened down.

We have often been called upon to account for the presence of some fruit floating in the syrup, whilst, on the other hand, some would sink. This is

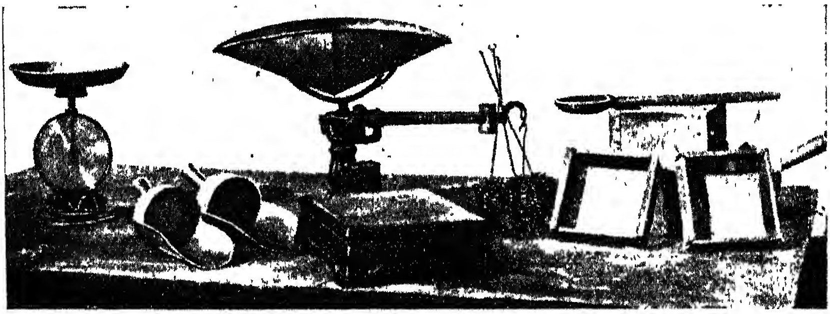


Fig. 14.—Some accessories.

easily explained, as it is simply a question of density. It is well known that it is easier to float in salt water than in fresh. The same principle applies to fruit—the denser or heavier the syrup, the more likelihood of the fruit floating. All fruits are not of the same density, and, naturally, the lighter ones float; but this becomes balanced in time by the laws of exosmosis and endosmosis, the fruit giving up its juices in exchange to the saccharine matter in the syrup.

Cooling Off—Cans and Jars.

If the goods are extremely delicate and liable to suffer by the heat, cool off the cans by turning on them a stream of cold water. This is especially advisable for large cans, because the larger the can, the longer it will take for the heat to reach the middle of the receptacle; therefore the longer the processing. Cooling off by laying the cans on the floor 1 inch apart is preferable; it prevents the rusting of the cans, but it requires a lot of room and more handling.

The glass jars cannot be well cooled off with cold water, or even cold air; a draught might cause some of them to crack and break. But the brisk cooling off is not a necessity; its object is to secure an even cooking of the contents of the sealed vessel.

Pulp.

This subject may be divided into two classes, viz., dry pulp, and pulp or wet pulp.

1. *Dry Pulp.*—Treating with dry pulp, the process is as follows :—Taking apricots as an example—the fruit should be ripe and well coloured ; wash,

Fig. 15.—Showing various styles of Preserving Jars in general use.

remove the stones ; place in cooking kettle, adding a little water at the start ; boil for at least one hour ; remove and place in the tins. After the tins have been filled with the hot pulp, solder down the cap, leaving a small hole in the centre ; place in boiling water for ten minutes, seal the vent, test, and then remove and cool. By this process the fruit becomes a mash ; it loses at least a third of its original weight, and it takes one hour and twelve minutes to produce the pulp.

2. *Pulp or Wet Pulp.*—This is a simpler process, saving weight and time, and in every way enhancing the appearance of the product. The fruit is cut in halves (the stones removed), washed, and packed in tins, say 10 lb. ; a little fresh water is added. Solder on the caps, leaving a small hole in the centre ; place in boiling water five minutes ; seal up vent, and cook for twelve minutes. This will produce a splendid article for either jam or pies, as the fruit will retain its flavour and original shape.

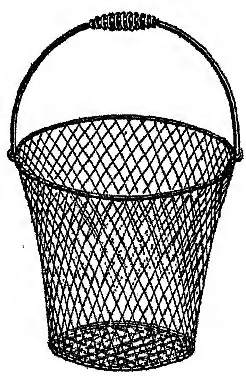


Fig. 16.—Wire Scalding Basket.

Conference of Governors of the United States.

The Conservation of Natural Resources.

In appointing the "Inland Waterways Commission," in 1907, President Roosevelt directed the Commissioners to "consider the relations of the streams to the use of all the great permanent natural resources, and their conservation for the making and maintenance of prosperous homes." During the course of their work, the Commissioners became more and more impressed with the value, and even necessity, of a national policy of conservation; and, at their suggestion, the President called together a Conference of State Governors to consider the problem in all its phases. In the invitation to the Governors, Mr. Roosevelt said :—

It seems to me time for the country to take account of its natural resources, and to inquire how long they are likely to last. We are prosperous now ; we should not forget that it will be just as important to our descendants to be prosperous in their time.

The Conference met at White House, Washington, on 13th, 14th, and 15th May, 1908. It included the President, Vice-President, and Members of the Cabinet of the United States ; the Chief Justice and Justices of the Supreme Court; the Governors of almost all the States and Territories comprised within the Federation ; representatives of 68 American organisations and industrial associations dealing with natural resources ; representatives of the American press ; bureau chiefs, and other experts of national reputation in the American service ; and the Inland Waterways Commission, who appointed a special Conference Committee to assist the President in general arrangements. Each State Governor was attended by three expert advisers.

This formidable body dealt with the natural resources of the United States in a great number of papers, addresses, and discussions, the subject having been divided into the following sections :—

1. Mineral Resources :—
   (*a*) Mineral fuels.
   (*b*) Ores and related minerals.
2. Land Resources :—
   (*a*) Soil.
   (*b*) Forests.
   (*c*) Sanitation.
   (*d*) Reclamation.
   (*e*) Land laws.
   (*f*) Grazing and stock raising.
3. Water Resources :—
   (*a*) Relations between rail and water transportation.
   (*b*) Navigation.
   (*c*) Power.
4. Conservation as a national policy

The Proceedings were subsequently printed by order of Congress, and a few copies have been received from the American authorities by the Hon. the Premier of New South Wales. It is a volume of 450 pages of information and expert advice on the resources of the United States and their conservation, and many of the recommendations made are worthy of application in all producing countries. An idea of their nature may be ascertained from a brief resumé of a few papers on subjects connected with agriculture.

The Evil Results of Continuous Cropping.

In an address on "The Natural Wealth of the Land and its Conservation," Mr. James J. Hill quotes some figures to show the effects of continuous cropping. Between 1880 and 1900 the value of the lands of Ohio shrank 60,000,000 dollars in spite of the increase in population. The year 1906 was one of large crops, in which the United States produced more corn than in any single previous year. Yet the average yield per acre was less than it was in 1872. The average yield of wheat in New York State for the last ten years was about 18 bushels per acre. For the first five years of the period it was 18·4 bushels, and for the last five years 17·4 bushels. The figures for the same periods in Kansas were 15·14 and 13·18 bushels, in Minnesota 13·12 and 12·8 bushels.

These and other dire results were produced by a system of tillage which has been "to select the crop which would bring in most money at the current market rate; to plant that year after year, and to move on to virgin fields as soon as the old farm rebelled by lowering the quality and quantity of the return. It is still the practice, although diversification of industry and the rotation of crops have been urged for nearly a century, and are to-day taught in every agricultural college in this country."

Mr. Hill was very pessimistic about the probable state of affairs, when in 1950, as it is estimated, the population of the United States will be 200,000,000; and he earnestly advises the American people to adopt the two common-sense remedies—the use of fertilisers and rotation of crops.

Surely these facts are sufficient to make us pause. We are just beginning to know the extent of the resources of our State, and our crop returns are increasing in both total and average. But reckless waste of nature's gifts will undoubtedly produce the same results here as it has already done in the Eastern and even some of the Western States of America. We have the advantage of their experience; let us, while there is yet time, adopt universally the precautions recommended by Mr. Hill—the application of fertilisers and rotation of crops.

Soil Wastage.

Professor T. C. Chamberlin, Head of the Department of Geology, University of Chicago, gave an address upon a question which is of great consequence to portion of our State—the fact that in unlevel country with good rainfall the amount of soil lost by erosion tends to greatly exceed the amount formed below by weathering action. He pointed to "the pitiable struggles of certain Oriental peoples to retain and cultivate the scant remnants of once ample soils" as an example and a warning.

The usual estimate, under ordinary American conditions, is a foot of soil wastage in 4,000 to 6,000 years. He estimates the rate of soil formation as not greater than a foot in 10,000 years. But of course on precipitous country the rate of loss is enormously greater. "When our soils are gone, we too must go, unless we can find some way to feed on raw rock or its equivalent.

The whole problem is involved in a consideration of the question of water and the solution is, "due control of the water which falls upon each acre.

It is an exceedingly complex problem, involving the several uses to which water is put. Portion should go to the bottom of the soil to promote soil formation; portion should go into the under-drainage to carry away harmful matter; portion should come up again to the surface, carrying solutions needed by the plants; and still another portion should run off the surface, carrying away a little of the leached soil matter. But the great outstanding feature is that "crops can use to advantage all the rainfall during the growing season, and in most cases crops are the better for all the stored surplus that can be carried over from the non-growing season."

Following the precedent supplied by nature, Professor Chamberlin urges the value of forest trees to prevent denudation of slopes. Berry-bearing shrubs, vines, or fruit-trees should be employed to the maximum, either alone or in conjunction with forests, in covering slopes; and shrubs should be evolved by modern selective methods whose nut-meats or dry seeds would be suitable for food, in place of the watery pulp, so that the culture of the cereals could be limited more largely to surfaces less subject to soil loss.

Again following nature, the "combination method" is urged. Legumes and cereals are helpful associates in rotation, and the principle should be pushed so far by skilful selection and proper culture that legumes and helpful associates should replace weeds as the constant and spontaneous companions of cereals Bare ground should be reduced to a minimum. Deep tillage promotes soil granules, and deep-rooting plants produce root-tubes—both of which are of great value in causing the maximum absorption of rainfall into the soil.

Fertilisers.

Mr. C. R. Van Hise, President of the National Association of State Universities, continuing the reasoning of Mr. Hill in a paper on "Conservation of Soils," went more deeply into the quantity of available fertilising materials in the United States. Nitrogen he considered safe enough, through the well-known action of leguminous plants in extracting that element from the air and making it available to other plants, as well as recent scientific discoveries in the direction of obtaining nitrogen from the air by electricity. The available quantity of potash in the United States, either in concentrated deposits or in the parent rock, he deemed ample for all needs. But he expressed great concern about the depletion of phosphorus in the soil, and foreshadowed the time when the United States would be compelled to prohibit the exportation of phosphate rock.

He urged that better methods of utilising the phosphorus in animal and human excreta should be adopted, and particularly referred to the enormous waste of this ingredient through the running of sewage into the streams, which Whitson estimated at 2 to 3 lb. of phosphoric acid per acre for the entire cropped region of the United States.

The question of fertilisers is already an important one in this young State, the large quantities of superphosphate now being used on our wheat lands warning us of the fact that every bushel of wheat taken off the land removes valuable plant-food from the soil.

One great method of restraining this depletion of plant-food is within the reach of every farmer. Wheat should be grown in rotation with leguminous and other fodder crops, and the fodder crops should be fed off by stock. The droppings will return to the land much of the fertilising material removed by the crops, the humus content of the soil will be preserved, and with rational manuring, the land will be as fertile in a thousand years as it is to-day.

Orchard Notes.

W. J. ALLEN

DECEMBER.

SERVICEABLE rains have fallen within the last six weeks in many of our fruit-growing districts; consequently, most of those orchards which have received the necessary care are looking well, and the coming crop gives promise of being above the average.

Cultivation.

The land should be cultivated and cross-cultivated immediately after rains; or, where irrigation is practised, after each watering. In addition to this, the soil around trees and vines which cannot be stirred with the cultivator should be broken up with the fork hoe. By following this system of working either orchards or vineyards, evaporation of soil moisture is prevented and the greatest amount of soil moisture conserved. An occasional working of the ground is necessary to keep it in proper condition, even though rain should not fall or irrigation be practised, as such a stirring will keep the weeds under and help to keep a proper soil mulch, which prevents excessive loss of moisture.

Where couch grass is found growing it should be either ploughed up or dug out on a hot day, so that the roots are exposed to the hot rays of the sun and drying winds, which soon kill them. After a ploughing they require frequent stirrings so as to bring as many of the roots as possible to the surface.

Fighting Pests.

So long as the Codlin Moth, scales, and other pests are with us, it will be necessary to maintain a systematic fight to keep them in check. To this end we must, for Codlin moth, give the trees an occasional spraying with arsenate of lead, and adhere to the systematic bandaging of all apple, pear, and quince trees, and the picking up and destroying of all fallen and infested fruit. It has been proved that by this means the greater proportion of the crops of apples and pears can be saved.

It is difficult to say just how many times it will be necessary to spray to keep the moth in check, but growers should use every endeavour to keep it under, and not try to economise by omitting an application. If in doubt as to whether or not the trees should be sprayed, it is best to err on the safe side and make the application, as it is often found that this pest is very active during the latter part of the season. It is frequently found, when harvesting operations commence, that had another spraying been given some time in January, the percentage of affected fruit would have been greatly reduced.

Fruit Fly.—See that all fallen fruit is regularly picked up and destroyed, either by burning or boiling. If growers neglect this important work they render themselves liable under the Fruit Pests Act. It is in the interest of every grower to prevent, as far as possible, the spread of diseases.

Scale Insects.—Either fumigate or spray for the purpose of destroying these pests. If fumigation is practised, see that it is carried out during early morning or late evening, or at night-time, but not during the heat of the day. Never fumigate after trees have been sprayed with Bordeaux mixture; otherwise the trees will be defoliated.

Pear Slug.—Cherry, pear, and other trees affected with Pear Slug should be sprayed with arsenite of soda or arsenate of lead. Two or three sprayings will usually keep them in check.

Vine Moth.—If this pest puts in an appearance, the vines should receive occasional dressings with arsenate of lead.

Irrigation.

Where this is practised, see that the soil in which the trees or vines stand is well soaked to a good depth; but avoid flooding, except for lucerne. Immediately the land is dry, start the cultivation and work the ground up to a good depth, and loosen up around all young trees and vines with a fork hoe.

Remove all suckers from trees and vines. This important work is too often neglected.

Drying Apricots.

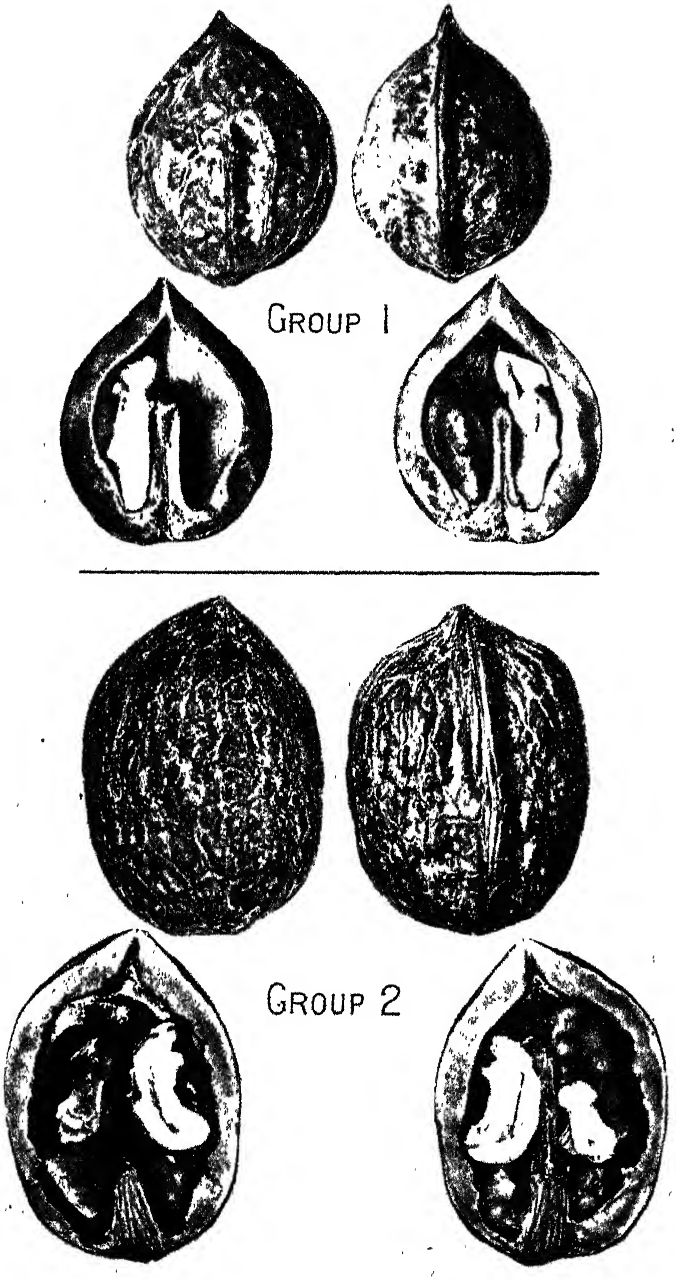
Apricot drying will commence this month. See that the fruit is properly ripe before it is picked; and immediately it is cut and placed on trays, remove it to the fumigator and keep it away from draughts and sun until it has been exposed to the sulphur fumes. After it has been subjected to the fumes for about three hours, the fruit may still remain in the closed room until the centre—that is the depression made by removing the stone—is full of juice. The fruit should then be placed in the sun and allowed to remain until most of the moisture is removed, when the fruit is found to be tough but not hard.

Varieties of Walnuts.

Group No. 1 (see Plate).—This variety is called Japanese Walnut. The tree is a quick grower, and makes a good shade tree, bears fairly well, is comparatively free from disease, but the nut has a thick, hard shell, and tastes somewhat like a Hickory nut. Not nearly so rich as the best walnuts.

Group No. 2.—The larger walnut is an imported nut of the better variety, and such as we should endeavour to grow, if we hope to find a market for our nuts.

The following are two or three of the better varieties to plant, viz:—Franquette, Mayette, Chaberte.



Two Varieties of Walnuts.

Government Stud Bulls available for service at State Farms, or for lease.

Breed.	Name of Bull.	Sire.	Dam.	Stationed at—	Engaged up till—
Shorthorn ...	Pansy Duke ...	Earl March ...	Pansy 4th (imp.).	Wollongbar Farm	†
,, ...	March Pansy ...	Earl March ...	Australian Pansy.	Grafton Farm ...	*
,, ...	Royal Hampton 10th (imp.).	Soliman ...	Orange Blossom 23rd.	Berry Farm ...	*
Jersey ...	Thessalian II. ...	Thessalian (imp.).	Egyptian Princess (imp.).	Wagga Exp. Farm	*
,, ...	Berry Melbourne	Melbourne (imp.).	Rum Omelette (imp.).	Berry Farm ...	*
Guernsey ...	Gentle Prince ...	Rose Prince (imp.).	Gentle ...	Wyrallah	7 Mar., '11.
,, ...	The King's Mirror.	Calm Prince ...	Vivid (imp.)...	Lismore	10 April, '11.
,, ...	Star Prince ...	Calm Prince ...	Vivid (imp.)...	Dunoon	3 April, '11.
,, ..	Prince Souvia ...	Vivid's Prince...	Souvenir(imp.)	South Woodburn..	21 Dec., '10.
,, ...	Monsieur Beaucaire.	Calm Prince ...	Flaxy (imp.)	Wollongbar Farm	*
,, ...	Claudius ...	Golden Star II..	Claudia's Pride (imp.).	H.A. College, Richmond	*
,, ...	King of the Roses	Hayes' King ...	Rose 8th (imp.)	Berry Farm ...	*
,, ...	Royal Preel ...	Otchen Royal ...	Hayes' Lily du Preel (imp.).	Cumbalum ...	10 Jan., '11.
Red Poll ...	The Judge ...	Barrister (imp.)	Lovely 8th (imp.).	Grafton Farm ...	*
Ayrshire ...	Don Juan ...	General (imp.)...	Judy 9th (imp.)	Bathurst Farm ...	*
,, ...	Royal Prince ..	Curly Prince ..	Rosie 5th ...	Grafton Farm ...	*
,, ..	Judy's Mischief	College Mischief	Kirkham Judy	Cowra Farm ...	*
,, ...	Jamie's Ayr ...	Jamie of Oakbank.	Miss Prim ...	Wollongbar Farm.	*
,, ...	Dan of the Roses	Daniel of Auchenbrain (imp.).	Ripple Rose...	H.A. College, Richmond	*
Kerry... ...	Kildare II ...	Kildare (imp.)...	Belvedere Bratha 3rd (imp.).	,, ,,	*
,, ...	Bratha's Boy ...	Aicme Chin (imp.).	Bratha 4th ...	,, ,,	*
,, ...	Rising Sun ...	Bratha's Boy ...	Dawn ...	Bathurst Farm ...	*

* Available for service only at the Farm where stationed. † Available for lease, or for service at the Farm.

Copies of the Regulations under which the Government Bulls are leased may be obtained on application to the Under Secretary, Department of Agriculture, Sydney.

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Department of Agriculture,
Sydney, 2nd December, 1910.

BULLS FOR SALE

BERRY STATE STUD FARM.

JERSEYS.—*Sir Pat: sire, Sir Jack; dam, Pattibelle; calved 21st March, 1909; colour, whole. Price, **£30.**

Pattibelle is by Lily's Boy, from Claribelle (imp.). Sir Jack, by Omelette's Pride, from Lady Tidy 3rd (imp.). Sir Jack fetched 170 guineas at auction.

***Best Blood:** sire, Berry Melbourne; dam, Lady Tidy 3rd (imp.); calved 3rd February, 1910. Price, **£30.**

This bull is out of the same cow as Sir Jack.

AYRSHIRE.—Sandy: sire, Auchenbrain Spicy Jock (imp.); dam, Rose Flower; calved 8th April, 1909; colour, brown and white. Price, **£20.**

Rose Flower is from Roseberry, by Daniel of Auchenbrain (imp.). Roseberry from Roseleaf of Barcheskie (imp.), by Mischiefmaker (imp.).

GUERNSEY.—Halley's Comet: sire, Star Prince; dam, Flaxy II; calved 1st September, 1909; colour, lemon and white. Price, **£45.**

Flaxy II is from Flaxy (imp.), by Rose Prince (imp.). Star Prince from Vivid (imp.), by Calm Prince.

Halley's Comet has a double cross of Rose Prince blood.

HAWKESBURY AGRICULTURAL COLLEGE.

AYRSHIRES.—Dado: sire, Daniel of Auchenbrain (imp.); dam, Dot, by Hover of Southwick (imp.), from Flirt, by Heir of Randwick (imp.), from Lady of Randwick; calved 23rd March, 1904; colour, white and brown. Price, **£15.**

Emerald's Mischief: sire, Prince Emerald (imp.): dam, Miss Prim, by Mischiefmaker of Barcheskie (imp.), from Primrose of Barcheskie (imp.), by Royal Stuart of Glenbuck, from Lindsay 7th of Barcheskie; calved 4th August, 1903; colour white and red. Price, **£25.**

WOLLONGBAR EXPERIMENT FARM.

HOLSTEINS.—De Wet: No. 184. Sire, Hollander; dam, La Shell; calved 12th May, 1909. Price, **£10.**

***Marjorie's Boy:** No. 223. Sire, Obbe II; dam, Marjorie; calved 23rd February, 1910 Price, **£15.**

Marjorie, by The Hague, from Lady Margaret, by Obbe (imp.), from Queen Margaret, by Max, 3028, from Margaretha (imp.).

AYRSHIRE.—Colonel: No. 211. Sire, Jamie's Ayr; dam, Colon; calved 26th December, 1909; colour, red and white. Price, **£15.**

GUERNSEYS.—Beresford: sire, Admiral; dam, Bijou de la Fontain (imp.); calved 16th March, 1909. Price, **£45.**

***Captain Hayes:** No. 218. Sire, Prince Souvia; dam, Hayes' Lily du Preel (imp.); calved 31st January, 1910. Price, **£40.**

***Tewkesbury:** No. 221. Sire, Prince Souvia; dam, Parson's Red Rose (imp.); calved 19th February, 1910. Price, **£45.**

H. C. L. ANDERSON,
Under Secretary.

*** Applications for these bulls will be held till 21st December. If more than one application be received for any one bull, his disposal will be decided by ballot.**

Sheep-maggot Fly.

Messrs. William Cooper and Nephews, 4, O'Connell-street, Sydney, are offering prizes of £50, £25, and £10 for the best three essays on the history, development, and present position of the maggot-fly trouble in Australia as it affects the sheep-growing industry. In making the awards, importance will not be attached to mere literary merit. The furnishing of the most useful, reliable, explicit, and practical information, bearing directly or indirectly on the fly trouble, is what will count.

The judges are Professor J. Douglas Stewart, of Sydney University; Mr. S. McCall-McCowan, Superintendent in Australia of the N. Z. and Australian Land Co., Ltd.; and Mr. A. S. Barton, of Polly Brewan Station, Walgett.

The conditions of the competition, and notes for the guidance of competitors, will be sent on application to Messrs. Wm. Cooper and Nephews, 4, O'Connell-street, Sydney.

Essays must be sent in on or before January 3, 1911.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1911.

Society.	Secretary.	Date.
Albion Park A. and H. Association	H. G. Fraser	Jan. 18, 19
Kiama A. Association	R. Somerville	,, 25, 26
Alstonville A. Society	W. W. Monaghan	Feb. 8, 9
Berry A. Association	C. W. Osborne	,, 8, 9
Moruya A. and P. Society	P. Flynn	,, 8, 9
Coramba District P., A., and H. Society	H. E. Hindmarsh	,, 15, 16
Shoalhaven A. and H. Association (Nowra)	H. Rauch	,, 15, 16
Gunning P., A., and I. Society	J. L. Sands	,, 22, 23
Manning River A. and H. Association (Taree)	S. Whitbread	,, 22, 23
Ulladulla A. Association (Milton)	J. Boag	,, 22, 23
Kangaroo Valley A. and H. Association	J. Moffit	,, 23, 24
Nambucca A. and H. Association	E. M. Walker	,, 23, 24
Wyong A. Association	J. H. Kay	,, 23, 24, 25
Central Cumberland A. and H. Association (Dural)	H. A. Best	,, 24, 25
Southern New England P. and A. Association (Uralla)	W. C. McCrossin	,, 28, Mar. 1, 2
Inverell P. and A. Association	J. McIlveen	,, 28, Mar. 1, 2, 3
Braidwood P., A., and H. Association	L. Chapman	Mar. 1, 2
Bega A., P., and H. Society	T. W. A. Zingel	,, 1, 2, 3
Robertson A. and H. Society	R. J. Ferguson	,, 2, 3
Bowraville A. Association	C. Moseley	,, 2, 3
Gundagai P. and A. Society	A. Elworthy	,, 7, 8

Society.	Secretary.	Date.
Bangalow A. and I. Society	W. H. Reading ...	Mar. 7, 8, 9
Tenterfield P., A., and M. Society	F. W. Hoskin ...	,, 7-11
Bombala Exhibition Society	W. G. Tweedie ...	,, 8, 9
Tumbarumba and Upper Murray P. and A. Society...	E. W. Figures ...	,, 8, 9
Macleay A., H., and I. Association (Kempsey) ...	E. Weeks ...	,, 8, 9, 10
Crookwell A., P., and H. Society (Annual Show) ...	M. P. Levy ...	,, 9, 10
Nepean District A., H., and I. Society (Penrith) ...	P. C. Smith ...	,, 9, 10
Berrima District A., H., and I. Society (Moss Vale)	I. Cullen	,, 9, 10, 11
Central New England P. and A. Association (Glen Innes)	G. A. Priest ...	,, 14, 15, 16
Campbelltown A. Association	F. Sheather ...	,, 15, 16
Cobargo A., P., and H. Society	T. Kennelly ...	,, 15, 16
Tumut A. and P. Association	T. E. Wilkinson...	,, 15, 16
Bellinger River A. Association (Bellingen)	S. S. Hindmarsh	,, 15, 16, 17
Mudgee A. Society	H. Lamerton ...	,, 15, 16, 17
Port Macquarie and Hastings District A. and H. Society	W. R. Stacy ...	,, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 16, 17, 18
Armidale and New England P., A., and H. Association	A. McArthur ...	,, 21-24
Camden A., H., and I. Society	C. A. Thompson ..	,, 22, 23, 24
Clarence P. and A. Society (Grafton)	T. T. Bawden ...	,, 22, 23, 24
Taralga A., P., and H. Association	G. C. Goodhew ..	,, 23, 24
Wauchope P., A., and H. Association	A. D. Suters ...	,, 23, 24
Newcastle A., H., and I. Association (Annual Show)	C. W Donnelly...	,, 23, 24, 25
Blayney A. and P. Association	E. J. Dann ...	,, 28, 29
Lower Clarence A. Society (Maclean)	F. W. Collison ...	,, 28, 29
Luddenham A. and H. Society	F. Shawe	,, 28, 29
Walcha P. and A. Association	J. New-Campbell	,, 28, 29
Yass P. and A. Association	W. Thomson ...	,, 29, 30
Cooma P. and A. Association	C. J. Walmsley ...	April 5, 6
Dorrigo A. Society	F. T. Stennett ..	,, 5, 6
Dungog A. and H. Association	C. E. Grant ...	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins ...	,, 5, 6, 7
Royal A. Society of N.S.W. (Sydney)...	H. M. Somer ...	,, 11-19
Queanbeyan P., A., H., and I. Association	E. C. Hincksman	,, 12, 13
Bathurst A., H., and P. Association	A. H. Newsham...	,, 26, 27, 28
Richmond River A. P. and H. Society (Casino) ...	D. S. Rayner ..	May 3, 4
Orange A. and P. Association	W. Tanner ...	,, 3, 4, 5
Hay P. and A. Association	G. S. Camden ...	July 11, 12
National A. and I. Association, Brisbane, Queensland	C. A. Arvier ...	Aug. 7-12
Murrumbidgee P. and A. Association (Wagga) ...	A. F. D. White ...	,, 22, 23, 24
Young P. and A. Association	G. S. Whiteman...	Sept. 5, 6, 7
Germanton P. and A. Society	J. S. Stewart ...	,, 6, 7
Junee P., A., and I. Association	T. C. Humphrys...	,, 6, 7
Albury and Border P., A., and H. Society	W. I. Johnson ...	,, 12, 13, 14
Temora P., A., H., and I. Association	J. Clark	,, 19, 20, 21

Contributions to the Farrer Memorial Fund.

Name.	Address.	Amount. £	s.	d.
Amount received up to 21st October, 1910		964	6	4
Farmers and Settlers' Association ...	Rylstone	1	1	0
Agricultural and Pastoral Association	Coolamon	1	1	0
Total amount received to 21st November, 1910 ...		£966	8	4

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Date of issue.	Date of issue.	Date of issue.